FISHERY MANAGEMENT INVESTIGATIONS

IDAHO DEPARTMENT OF FISH AND GAME
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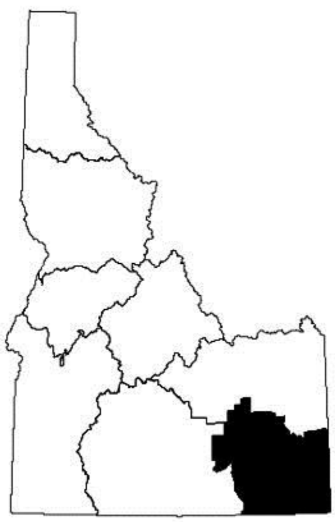

SOUTHEAST REGION

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LOWLAND LAKE AND RESERVOIR INVENTORIES AND SURVEYS

ABSTRACT

In 2010, Johnson Reservoir was identified as an underperforming fishery. From 2011 to 2014, we stocked a total 223 Largemouth Bass *Micropterus salmoides* (LMB) over 270 mm to improve the size structure of the Bluegill *Lepomis macrochirus* population. The Bluegill proportional stock densities (PSD) increased from 2 in 2010 to 39 in 2015. Bear Lake was trawled for Bear Lake Sculpin *Cottus extensus* during August. We captured an average of 78 adult sculpin per trawl which converts to a population estimate in excess of 3 million. We evaluated Largemouth Bass PSD in four Franklin County reservoirs. Condie Reservoir had the highest LMB PSD estimate of 68 followed by Lamont (31), Johnson (33), and Winder (6). We continued to monitor the Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* population at Blackfoot Reservoir. In 2015, trout represented about 26% of the catch, which was the highest observed in several decades and was similar to historic levels (31%).

Johnson Reservoir

Introduction and Methods

Johnson Reservoir is located in Franklin County near Preston, Idaho. When full, Johnson Reservoir has a surface area of approximately 20 ha and has an elevation of 1,485 m. The reservoir is used primarily for irrigation storage but also provides angling opportunities for Largemouth Bass *Micropterus salmoides* (LMB), Bluegill *Lepomis macrochirus* (BG), Yellow Perch *Perca flavescens,* and Rainbow Trout *Oncorhynchus mykiss*. Tiger muskellunge *Esox lucius x E. masquinongy* were stocked in the past to provide a trophy component and to help reduce an over-abundance of BG less than 170 mm. The tiger muskie program, however, was criticized by anglers and was discontinued.

During 2010 we identified Johnson Reservoir as an underperforming fishery due its high catch rates of undesirable sized BG. Over the past decade, BG Proportional Stock Density (PSD) has been well below what should be observed in a balanced population (50%-80%; Figure 1). In an attempt to improve the size structure of the BG fishery, we began transferring LMB into Johnson Reservoir to increase predation and improve growth rates. During 2011-2014, we collected LMB from surrounding Franklin County reservoirs and relocated them to Johnson Reservoir. No LMB were transferred in 2015. All LMB transferred to Johnson were large enough (≥275 mm) to prey on juvenile BG.

Predator and prey populations were monitored using boat mounted electrofishing gear. All fish captured were weighed (g), measured (mm; TL) and released. To avoid sampling newly stocked LMB, all surveys were conducted prior to LMB transfers.

Results and Discussion

The predator enhancement program appears to be having the desired impact on improving the PSD of BG. In 2010 and 2011 (prior to the implementation of this project) the BG PSD was two and six percent, respectively (Figure 1). The BG PSD increased substantially to 31% in 2012 and again to 40% in 2013. In 2014, BG PSD was 54%; the highest PSD ever observed (Figure 1). However, BG PSD decreased to 39% in 2015. We think the decrease in BG PSD can be attributed to a strong year class of BG being recruited to the fishery (Figure 2). This result suggests that while our efforts have made gains in increasing BG PSD, Johnson Reservoir still lacks a large enough standing stock of LMB over 305 mm to effectively control the bluegill population.

Overall, Bluegill relative weight (W*r*) has increased over the course of the project. In both 2010 and 2011 (prior to LMB augmentation) BG W*r* was similar at 87%. However in 2012, 2013, 2014, and 2015 BG Wr was 98%, 93%, 95%, and 94%, respectively; all significantly higher than in 2010 and 2011 (ANOVA; F = 19.782; df = 5; P = 0.0001). Even though Wr has not yet reached 100%, the values observed from 2012-2015 indicate good body condition and appropriate abundance for the available habitat. (AFS & IDFG use the Oxford comma)

Historically, LMB PSD has been low in Johnson Reservoir. Largemouth Bass PSD has not reached 40% (Ideal range 40%-60%) in the last 10 Years (Figure 3). Chronically low LMB PSDs likely explains the imbalance in the BG population.

Largemouth Bass transfers occurred in June of 2011, October of 2012, June of 2013, and again in June of 2014. Size and number of LMB transferred to Johnson Reservoir over the course of the project are presented in Table 1.

In summary, the BG population in Johnson Reservoir appears to be responding positively to augmentation of LMB. However, LMB PSD remains well below objective. A polymodal size structure is indicative of a population not overexploited by anglers. However, the LMB population in Johnson Reservoir shows a unimodal size distribution which indicates the LMB fishery is overexploited (Figure 4; Beamish et. al 2006). Other reservoirs in the region also have overexploited LMB fisheries (Figure 5). In 2015, we proposed a LMB regulation change that if adopted, would reduce angler exploitation and help area LMB/BG fisheries reach their PSD objectives (LMB 40%-%60; BG 50%-80%; Gabelhouse 1984). See Brimmer et al. 2015 for complete details. As of this writing, the proposed regulation change was adopted by the Idaho Department of Fish and Game Commission and became effective on 1 January 2016. We will evaluate the efficacy of this regulation change over the course of the next few years.

<u>Bear Lake Sculpin Trawling</u>

Introduction and Methods

Bear Lake is a 28,328 ha lake located in northern Utah and southeast Idaho. The Utah-Idaho border roughly bisects the 32 km long lake in half and the lake is 8-13 km in width. It has a maximum elevation of 1,806 m above sea level. The maximum depth, when at full pool, is 63 m and average depth is 26 m. Most of the lakebed is covered in fine marl sediment. Primary and secondary production are thought to be limited by precipitation of calcium carbonate, which strips phosphorous from the water column (Birdsey 1989). The precipitate also gives the lake its famous turquoise iridescence.

St. Charles, Swan, Big Spring, and Fish Haven creeks are the primary natural tributaries to the lake. In addition to the natural tributaries, the Bear River is diverted into Bear Lake. In 1911, a canal was constructed to divert the Bear River at Stewart Dam into Bear Lake. The water delivery system stores spring runoff water in Mud Lake which gravity flows into the northeast corner of Bear Lake. Pacific Corp operates the top 6.4 m of the lake as irrigation storage, through a legal decree (Kimball Decree). The stored water is pumped out of the lake during the summer irrigation season and delivered back to the Bear River through the outlet canal.

Bear Lake's fish community supports four endemic species: Bonneville Whitefish (*Prosopium spilonotus*), Bear Lake Whitefish (*P. abyssicola*), Bonneville Cisco (*P. gemmifer*), and Bear Lake Sculpin (*Cottus extensus*). Bear Lake also supports one of two remaining native adfluvial stocks of Bonneville Cutthroat Trout (*Oncorhynchus clarkii utah*).

In 2010, the Bear Lake Management Plan (Plan) was finalized. The Plan specifically outlined a monitoring program for Bear Lake Sculpin. Bear Lake Sculpin (Sculpin) have been monitored since the 1980s first by Utah State University and later by the State of Utah. In 2010, Idaho Department of Fish and Game took over monitoring responsibilities. The management objective for Bear Lake Sculpin is to maintain a minimum population of 1-2 million adult Sculpin which translates to a mean density of 25 – 50 age-1 (or older) Sculpin captured per standard 20 minute trawl. If Sculpin numbers fall below a mean density of 25 adult Sculpin per trawl (1 million Sculpin), then Lake Trout (*Salvelinus namaycush*) stocking will cease and Bonneville Cutthroat Trout stocking may be reduced until the Sculpin population rebounds. For complete details on the Bear Lake Management Plan see Tolentino and Teuscher (2010).

Bear Lake Sculpin were sampled during the new moon phase during 12-13 August, 2015. We sampled Sculpin with a semi-balloon otter trawl with a head rope of 4.9 m attached to two otter boards. The net had a mesh size of 12.7 mm with the cod-end containing a 5.0 mm mesh liner. We sampled at three locations (First Point, Gus Rich, and Utah State Marina; Figure 6) and at two depths: where the top of the thermocline intersected with the lakebed (10 m) and where the bottom of thermocline intersected with the lakebed (19 m). At each location a total of six, 20-minute trawls were conducted (3 at the top and 3 at the bottom of the thermocline) for a total of 18 trawls. Boat speed was maintained as close to 1 m/s as possible. Trawling began at about 2100 hrs and ended at approximately 0400 hrs. All adult (>35 mm) Bear Lake Sculpin and non-target fish encountered were counted and measured (Total Length) to the nearest millimeter and released. Young-of-the-year Sculpin were counted and released.

Results and Discussion

Adult Sculpin density was lowest in shallow trawls and averaged about 66 adult Sculpin per trawl. Mean adult Sculpin density was considerably higher in deep trawls (90 fish/trawl; Figure 7). First Point had the highest overall mean adult Sculpin density of 88 fish/trawl followed by Utah State Marina at 80 fish/trawl and Gus Rich at 66 fish/trawl. The overall mean adult Sculpin (≥35 mm) catch per trawl was 78, which converts to a minimum population estimate of about 3 million adult Sculpin. See Figure 8 for overall mean adult sculpin trends for the past 15 years.

Largemouth Bass Surveys

Introduction and Methods

In the early 1990s, a comprehensive research study was initiated to better understand the biology of Largemouth Bass *Micropterus salmoides* (LMB) in Idaho (Dillon 1991). That study indicated water temperature was a key factor controlling LMB productivity. Several other studies described growth potential of LMB across their natural range (McCauley and Kilgour 1990; Beamesderfer and North 1995). Those studies coupled with Dillon (1991) identify the maximum growth potential for LMB in the predominately coldwater lakes and reservoirs in Idaho. However, many other factors can contribute to the population structure and success of a LMB fishery. Most importantly are harvest, lake productivity, and interaction among fish species (i.e., competition and predation). Monitoring of those variables is necessary to maintain or improve LMB fisheries in southeast Idaho.

Electrofishing surveys were completed on four southeast Idaho reservoirs in 2015. All of the reservoirs are small (<200 ha), shallow, and productive (Table 2).

Largemouth Bass and potential prey species abundance were evaluated using shoreline electrofishing. Target species for included LMB and Bluegill *Lepomis macrochirus* (BG). Catch-per-unit-effort (CPUE) was used to compare the relative abundance of LMB among the different reservoirs. The CPUE data were collected using nighttime shoreline electrofishing with boat-mounted equipment. All electrofishing was completed in June between 2100 and 0400 hours. While electrofishing, netting effort varied depending on catch rates. The first priority was to obtain a random sample of all species. In some waters, BG densities were too high to continually net that species and achieve the sample goal for LMB. In such cases, selective netting for LMB was implemented. Size selective netting periods for LMB were not included in CPUE or Proportional Stock Density (PSD) analysis. Fish were weighed to the nearest gram and measured for total length (mm).

Results and Discussion

Catch rates of warmwater species varied markedly among reservoirs. Bluegills were most abundant in Johnson Reservoir followed by Lamont, Winder, and Condie reservoirs, respectively (Table 3). Largemouth Bass were most abundant in Lamont Reservoir and the least abundant in Winder Reservoir (Table 3).

Proportional Stock Density trends for most of the Southeast Region reservoir fisheries are highly variable (Table 4). Generally, the lowest LMB PSDs are observed in reservoirs that are managed under general angling regulations suggesting that once LMB are recruited to legal size, they are harvested by anglers (Figure 9). While protective harvest regulations may moderate the fluctuations in PSDs, they do not guarantee quality fishing. For example, Condie Reservoir is managed using the trophy bass rule of no harvest of LMB under 508 mm. Despite the conservative harvest rule, the PSD in this reservoir fluctuates widely (Table 4).

Similar to LMB, BG PSDs were also variable in the reservoirs surveyed. Condie had the highest BG PSD followed by Winder, Johnson, and Lamont reservoirs (Table 3). Furthermore, the high BG PSD observed in Condie Reservoir is likely the result of the high LMB PSD that is also found there (Table 3). See *Johnson Reservoir* in this report for more information.

Blackfoot Reservoir

Introduction and Methods

Blackfoot Reservoir is located on the Blackfoot River in Caribou County north of Soda Springs, Idaho. Its primary uses are irrigation storage and flood control. The U.S. Bureau of Indian Affairs regulates the dam and reservoir. At full capacity, the reservoir is at 1,865 m elevation, covers 7,285 ha, and contains 432,000,000 m^3 of water. Refilling begins in October and continues through spring. Irrigation use begins in June with drawdown beginning as irrigation demand exceeds inflow.

Historically, Blackfoot Reservoir was a premier fishery for large (>500 mm) Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* (YCT). The fishery slowly deteriorated and eventually crashed in the early 1980s. In 1989, a comprehensive plan to reestablish a fishery for wild Yellowstone Cutthroat Trout was formulated after several years of study (LaBolle and Schill 1988). It called for elimination of YCT harvest from Blackfoot Reservoir. In order to provide a harvest fishery, large numbers of both hatchery Rainbow Trout *O. mykiss* (RBT) and hatchery Bonneville Cutthroat Trout *O. c. utah* (BCT) originating from Bear Lake were stocked. Attempts were made for BCT to establish their own natural spawning run into the Little Blackfoot River. Bonneville Cutthroat Trout stocking was discontinued in 1994. Rainbow Trout stocking was increased as a replacement. We started by stocking catchables and fingerlings in the spring. However, after a few years of evaluation it was clear these fish were not recruiting to the fishery. In response to our findings, we switched to a fall release of triploid RBT catchables.

Currently, predation by the American White Pelican *Pelecanus erythrorhynchos* (AWP) is threatening a genetically unique population of YCT in the Blackfoot River system. The adult AWP population at Blackfoot Reservoir increased from a few hundred in 1993 to a peak of 3,416 in 2007. In 2015, the AWP population was about 1,466 individuals. Conversely, the adult population of YCT declined from 4,747 in 2001 to about 190 in 2015. Both AWP and YCT are classified by IDFG as species of special concern. In addition to special concern status, recent genetic work showed that Blackfoot River YCT trout carry unique genetic markers not found in any other YCT population.

We had three objectives associated with this project. First and second, we wanted to assess the status of the Smallmouth Bass *Micropterus dolomieu* (SMB) and YP population. Lastly, we wanted to assess the relative performance of hatchery RBT that have been stocked in the reservoir.

During July of 2015, we sampled Blackfoot Reservoir with gillnets (floating and sinking), electrofishing, and trawling. Gill nets measured 42 m x 2 m with six panels composed of 19, 25, 32, 38, 51, and 64 mm bar mesh. The combination of one floating and one sinking net, fished overnight equaled one unit of gill net effort. Overall, we applied four units of gillnet effort. We used boat mounted electrofishing equipment utilizing standard pulsed DC waveforms to survey Blackfoot Reservoir. One unit of effort equaled one hour of electrofishing. Overall we applied three units of effort. See Figure 10 for gillnet and electrofishing sampling locations. We also used a semi-balloon otter trawl with a head rope of 4.9 m attached to two otter boards to sample Yellow Perch *Perca flavescens* (YP). The net had a mesh size of 12.7 mm with the cod-end containing a 5.0 mm mesh liner. See Teuscher and Scully (2004) for complete trawling methods and locations. All fish captured were identified, enumerated, measured to the nearest mm (total length; TL) and weighed to the nearest gram. Occasionally, catches were too large to measure and weigh every fish. In these cases, we sub-sampled a portion of the total catch.

Results and Discussion

Over the past decade, subtle changes have occurred in the Blackfoot Reservoir fishery. Non-trout species continue to dominate the fishery but for the first time since 1964 their relative abundance has been less than 80% (Table 5). This downward trend began in 2009 when the relative abundance of non-trout species went from 97% in 2005 to 91%. Non-trout species relative abundance declined again in 2011 to 85% (Table 5). In 2015, non-trout relative abundance was 74%; the lowest since 1963.

As expected, hatchery RBT continue to recruit to the fishery. We switched to fall stocking (after AWP have migrated) of RBT in 2004. While this initial stocking effort did not show up in the 2005 sample, these fall plants are now recruiting to the fishery with regularity (Table 5). Of the 63 hatchery RBT captured in 2015, 61 were of quality size. These fish (n = 63) had a mean length and weight of 454 mm and 1,061 g, respectively. Analysis of the length frequency histogram suggests that several cohorts were present at the time we sampled but there was substantial overlap between the groups (Figure 11). Currently, the trout fishery appears to be driven largely by the Department’s stocking program. Yellowstone Cutthroat Trout abundance remains low and contributes little to the sport fishery (Table 5). American White Pelican predation on YCT adults and juveniles - particularly when they are in the Blackfoot River system - is preventing this population from reaching its full potential (Teuscher et al. 2015).

Electrofishing catch was similar to gillnet catch. Overall we captured 114 fish during our electrofishing surveys. Non-trout species dominated the catch and comprised about 89% of the total catch. Rainbow Trout and Yellowstone Cutthroat Trout accounted for about 11% of the catch. The paucity of trout in the catch was likely due to conditions encountered during the surveys. At the end of July, surface water temperature was relatively high at 20°C (68°F). We think the majority of trout were located in deep water during our surveys and were not within reach of our electrofishing gear.

Smallmouth Bass were encountered and documented at Blackfoot Reservoir for the first time in 2015. We have been receiving anecdotal accounts of their presence in the reservoir since 2007 but had never sampled any until 2015. We caught one SMB in a gillnet and five via electrofishing. Overall these SMB had a mean length and weight of 169 mm and 83 g, respectively. These SMB originated from an illegal introduction that probably occurred sometime during or after 2007. It is not known at this time what the impacts may be on the fishery but we plan to monitor this population in the future.

No Yellow Perch were encountered during our surveys in 2015. Historically, YP were encountered in both trawling surveys and gillnet surveys. In 2001, (the last time trawling occurred) we captured a total of 564 (142 fish/trawl) YP (Figure 12; Teuscher and Scully 2004). Since then, YP have been encountered most years that gillnetting surveys were conducted (Table 5). It is unclear why no YP were sampled in 2012 or 2015, but we speculate that the decline in YP abundance may be related to reservoir conditions during early spring. Yellow Perch initiate spawning activities in late April at Blackfoot Reservoir. The last time the reservoir was above 80% full pool in April was in 2000. The following year, numerous age-1 YP were sampled. This result suggests that YP successfully spawned in 2000. Furthermore, age-2 and -3 YP were also captured in the trawl and gillnets that year which suggests there were previous successful spawning events. In both 1998 and 1999, April reservoir level was above 80% full pool which corresponds with the age-2 (1999) and -3 (1998) fish captured during the survey. However, since 2000 the reservoir has been well below 80% full pool in April with one exception (2012). Since 2000, we think there has been little to no annual recruitment because in years when the reservoir is below 80% full pool in April, no suitable spawning habit is available. This could explain the decline in YP abundance over the past decade. However, in 2012 the reservoir was at 92% full pool in April but there was no evidence of a successful spawning event. We think that even though there was adequate spawning habitat available, there were simply too few YP left to utilize it. We plan to monitor this population in the future.

MANAGEMENT RECOMMENDATIONS

Evaluate whether the change to 14” minimum length for Largemouth Bass in 2016 is effective at increasing bass PSD in Southeast Region bass fisheries.

RIVERS AND STREAMS INVESTIGATIONS AND SURVEYS

ABSTRACT

We surveyed the Blackfoot River fish community using electrofishing and trap nets in 2015. Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* (YCT) escapement (n = 190) in 2015 was still well below the highest observed on the Blackfoot River (n = 4,747). Furthermore, the population of YCT on the Blackfoot River Wildlife Management Area continues to be below historical levels. We think these low levels can be attributed to continued predation by American White Pelicans *Pelecanus erythrorhynchos*. We evaluated reservoir, adult migrant conversion rates, repeat spawner frequencies, and sex ratios for Blackfoot River YCT. Our estimates of reservoir survival were much higher than those in the past and are likely explained by changes in fishing regulations. Sex ratios were generally higher than past observations and appear to be trending upward. The high sex ratio may be a compensatory response to low adult escapement. Nine streams were sampled within the Riverdale Management Unit (MU), nine sites in the Thatcher MU and two sites within the Malad MU for Bonneville Cutthroat Trout *O. c. utah* (BCT). Overall, mean BCT density was 3.6 fish/100 m^2 and ranged from 0.0 – 7.5 fish/100 m^2.

Yellowstone Cutthroat Trout Monitoring in the Blackfoot River System

Introduction and Methods

There are two long-term monitoring programs in place for Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* (YCT) in the upper Blackfoot River. They are adfluvial escapement estimates and river density estimates. Adfluvial escapement estimates are derived from fish captured at an electric weir trap located in the lower river near its confluence with Blackfoot Reservoir. The density estimates are derived from fish captured within a portion of the Blackfoot River Wildlife Management Area (BRWMA) located about 51 km above the reservoir. The adfluvial escapement estimates have been completed every year since 2001. The river density surveys are completed less frequently.

An electric fish migration barrier was installed in the Blackfoot River in 2003 to collect migrating adult YCT. The barrier includes a trap box designed using Smith Root Inc. specification. The barrier components include four flush mounted electrodes embedded in Insulcrete, four BP-POW pulsators, and a computer control and monitoring system. The computer system can be operated remotely, records electrode outputs, and has an alarm system that triggers during power outages. Detailed descriptions of these components and their function can be obtained at www.smith-root.com.

The electric barrier was operated from 28 April to 9 June 2015. Prior to observing fish at the trap, field crews checked the live box several times a week. Once fish began entering the trap, it was checked at least once a day. Fish species and total lengths (mm) and weights (g) were recorded. Yellowstone Cutthroat Trout were visually checked for bird scars. Bird scar monitoring began in 2004. Scar rates were associated with increases in pelicans feeding in the Blackfoot River downriver of the trap. One half of all YCT handled at the trap were injected with a 23 mm half-duplex Passive Integrated Transponder (PIT) tag purchased from Oregon RFID (www.oregonrfid.com). These fish were tagged so they could be included in a pelican predation study.

In 1994, the Idaho Department of Fish and Game (IDFG), with assistance from the Conservation Fund, purchased the 700-ha ranch and began managing the property as the BRWMA. The BRWMA straddles the upper Blackfoot River, with an upper boundary at the confluence of Lanes, Diamond, and Spring creeks and a lower boundary at the head of a canyon commonly known as the upper narrows. Approximately 9 km of river meander through the property along with 1.6 km of Angus Creek, which is an historical YCT spawning and rearing stream. Since purchasing the BRWMA, IDFG has completed periodic population estimates to monitor native YCT abundance.

We estimated YCT abundance within 5.2 km of the BRWMA reach of the Blackfoot River in 2015. The estimate was completed using mark-recapture methods. Fish were sampled with drift boat-mounted electrofishing gear employing standard pulsed DC waveforms. All YCT captured were injected (marked) with a 23 mm PIT tag (www.oregonrfid.com), measured for total length (mm) and weighed to the nearest gram and released. Fish were marked on 22 June and recaptured 25 June 2015. Data were analyzed using Fish Analysis + software package (Montana Fish Wildlife and Parks 2004).

Similar to 2013 and 2014, non-lethal hazing and lethal take of American White Pelicans *Pelecanus erythrorhynchos* (AWP) was utilized again in 2015 in an attempt to reduce predation impacts on migrating YCT. From May through July, hazers patrolled the river from the confluence with the reservoir to the adult escapement trap and from the lower boundary of the BRWMA to the confluence of Lanes and Diamond Creeks on foot or via ATV (Figure 13). When groups of pelicans were observed on the river, hazers launched explosive pyrotechnics towards the group of birds to scare them off the river. Hazing crews also enumerated the birds encountered each day. In addition to non-lethal hazing, lethal take was also used to discourage pelicans from using the river. Lethal take occurred in concert with non-lethal hazing.

Results and Discussion

In 2015, a total of 190 adult YCT were collected at the migration trap. Of these, 166 were females and 13 were males. Captured females and males had a mean length of 503 and 520 mm, respectively. The bird scarring rate observed in 2015 was 7%; the lowest observed since 2010. Scarring rates have varied from no visible scars on fish collected in 2002 to a high of 70% scarred in 2004. Scarring rates may be related to the predation rate by pelicans, but no information is available to determine the relationship. Variation in scarring rates is likely impacted by the overall number of pelicans feeding on the river below the migration trap, water levels and clarity, and hazing efforts exerted on the birds to reduce predation impacts. Adult YCT escapement and bird scar trends are shown in Table 6.

A total of 254 YCT were sampled on the BRWMA during the mark and recapture electrofishing surveys (Table 7). The number of YCT captured in 2015 was similar to 2014 but slightly higher than in 2012. We think AWP predation on BRWMA YCT was a contributing factor to the low numbers of YCT encountered during the last four years (Teuscher et. al 2015).

In past surveys of the BRWMA reach, juveniles (<300 mm) dominated catch. Thurow (1981) reported that about 80% of the fish caught during population surveys were less than 300 mm total length. Results from 2011, 2012, 2013, and 2014 surveys show similar ratios of juvenile cohorts (Figure 14).

Hazing and lethal take began on May 5, 2015 and continued through June 29, 2015. Birds were hazed 1-2 times daily from the YCT trap downstream to the river's confluence with the reservoir (about 2.0 km). Efforts to haze birds on the upper River on or near the BRWMA occurred concurrently with activities on the lower river (the BRWMA is about 38 Km above the reservoir; Figure 13).

Overall, 3,107 AWP were observed during hazing activities. Of these, 493 occurred from the mouth of the river to the YCT escapement trap, one on the BRWMA and 2,573 near the river/reservoir confluence. During the same period, we expended a total of 449 non-lethal pyrotechnic projectiles and 183 shotgun shells. Overall, 61 AWP were lethally taken during the hazing period (Figure 15).

Hazing activities combined with lethal take appears to be effective in reducing AWP use of the Blackfoot River. In general, it appears that when take exceeds two birds per day, AWP use of the river declines. Conversely, when only hazing occurs, AWP use of the river increases (Figures 15, 16, and 17; Brimmer et al. 2015).

In summary, we conclude that AWP use of the river can be reduced by intensive hazing efforts coupled with the aggressive lethal take of birds. It appears that lethal take must exceed two birds per day to achieve the desired outcome.

Yellowstone Cutthroat Trout Life History Investigations on the Upper Blackfoot River and Blackfoot Reservoir

Introduction and Methods

Blackfoot River and Blackfoot Reservoir are located in Caribou County, north of Soda Springs, Idaho. The river begins at the confluence of Lanes and Diamond creeks at the upper end of the basin and ultimately joins with the Snake River near the city of Blackfoot, Idaho. However, for the purposes of this report, our discussion will focus on the reservoir and the river above it (Figure 18).

During the 1980s, extensive Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri* (YCT) studies were conducted on the upper Blackfoot River and Blackfoot Reservoir (La Bolle and Schill 1988; Thurow 1981). These studies examined various YCT life history metrics such as reservoir survival, length at age, migration timing, and adult escapement. Various habitat variables were also examined. Our objective was to compare recently collected data for reservoir survival, adult spawner conversion rates, and sex ratios of YCT to the historical condition.

Yellowstone Cutthroat Trout were collected at two locations during our study (2010-2015). We collected migrating adult YCT at an adult migrant electric weir trap located on the lower river near its confluence with the reservoir (Figure 18). Both adult and juvenile YCT were also collected on the Blackfoot River Wildlife Management Area (BFRWMA; see Brimmer et al. 2015 for details). The adult migrant electric weir trap (trap) consisted of a trap box and electric weir designed to Smith Root Inc. specifications. The barrier (weir) components of the trap include four flush mounted electrodes embedded in Insulcrete that spans the width of the river and four BP-POW pulsators that energize the weir. Detailed descriptions of these components and their function can be obtained at www.smith-root.com.

The trap was operated from late April to mid-June annually from 2010 through 2015 with one exception. During 2011, river discharge was too high to operate the trap during the migration run so no YCT were tagged there. We checked the live box several times a week until YCT were observed in the trap box. Once fish arrived at the trap, we began checking it at least once a day. When YCT numbers were high (>20), the trap was checked and cleared several times per day. We recorded sex, total length (mm), and weight (g) for all YCT caught at the trap. In addition, YCT handled at the trap were also injected with a 23 mm half-duplex Passive Integrated Transponder (PIT) tag purchased from Oregon RFID (www.oregonrfid.com). All YCT handled at the trap were anesthetized before data collection began and then allowed to recover before being released back to the river.

Yellowstone Cutthroat Trout sampled from the BFRWMA were collected with drift boat mounted electrofishing gear using standard pulsed DC waveforms. All YCT captured were anesthetized, injected with a 23 mm PIT tag (www.oregonrfid.com), measured for total length (mm) and weighed to the nearest gram and released. Fish were collected from 2010-2015 during the months of May, June, July, and August.

Tagged YCT were subsequently recovered at three locations during the study. Two passive PIT tag arrays were deployed in the river, one about 1 km below the trap and the other on the BFRWMA (Figure 18). See Brimmer et al. 2010 for complete PIT tag array details. The PIT tag arrays were operated annually from late April through October. The last tag recovery location was at the trap. All YCT captured at the trap were also scanned for tags. We treated recaptured (tagged in a previous year) fish as “newly tagged” fish and they were included in the current year’s dataset.

We used the PIT-tagged YCT to assess the various life history attributes. To estimate overall reservoir survival, we used YCT tagged on the BFRWMA that were less than 400 mm TL. Of these fish, only YCT that were detected at the lower array were used. The fish that were detected at the lower array were out-migrants heading to the reservoir. We considered YCT that were detected at the lower array in subsequent years to be “survivors” since they were returning to spawn in the Blackfoot River. To estimate reservoir survival, we divided the number of survivors by the total number of fish that migrated to the reservoir. The resulting number was then converted and reported as a percentage. Due to the length of the YCT life cycle (6-8 years), we only report reservoir survival estimates for 2010 and 2011.

Adult YCT caught in the trap were tagged and released. Their conversion rate (migration survival to the BFRWMA) was estimated using tag interrogations at the BFRWMA array. That array was about 40 km above the trap (Figure 18). Our estimated conversion rates were conservative because we assumed 100% detection efficiency at the array. These results are reported as a percent.

Lastly, we report sex ratios as the number of females per male, by year.

Results and Discussion

Reservoir survival was similar in 2010 and 2011. In 2010, a total of 16 YCT passed the lower PIT tag array on their migration to Blackfoot Reservoir. Over the next four years, a total of seven YCT returned to the lower array or to the trap which resulted in a survival estimate of about 44%. Likewise, in 2011, 71 YCT were detected leaving the river and a total of 30 returned (42%). These survival rates are much higher than reported by LaBolle and Schill (1988). In their study, they estimated reservoir survival to be around 28% in both 1977 and 1988. However, since the completion of those studies, YCT harvest has been closed in the reservoir. This fishing regulation change likely explains the difference between our survival estimates.

Adult Yellowstone Cutthroat Trout conversion rates varied over the course of the study. Conversion rates ranged from a low of 15% in 2013 to a high of 84% in 2014. In 2013, the run was delayed by about three weeks due to a large concentration of American White Pelicans *Pelecanus erythrorhynchos* at the mouth of the river. These birds had effectively blocked access to the river for YCT. Once the birds had been dispersed, the run resumed (Figure 17). However, these migrants had likely missed their opportunity to asend to the upper basin by then. We suspect this is the reason the conversion rate was so low in 2013 (Brimmer et al. 2015).

Sex ratios appear to be changing. Thurow (1981) reported that sex ratios of adult YCT that entered the river typically ranged from 2.1 females per male to 3.2 females per male. The lowest two years we observed (2010 and 2013) had ratios just under 3 females per male. However, the remaining year’s ratios were much higher than reported historically (Figure 19). We used linear regression to analyze these data to identify trends. Our results show that sex ratios appear to be increasing over time (Figure 19). At this time we do not know what mechanism is driving the sex ratio upward.

Bonneville Cutthroat Trout Monitoring Program

Introduction and Methods

Bonneville Cutthroat Trout *Oncorhynchus clarkii utah* (BCT) are one of three native cutthroat trout subspecies in Idaho. The distribution of BCT is limited to the Bear River Drainage in Southeastern Idaho. In the early 1980s, distribution and abundance data for this native trout were deficient. Initially, to better understand BCT population trends and the potential influence of natural and anthropogenic processes, a long-term monitoring program was initiated for three tributary streams of the Thomas Fork Bear River (Preuss, Giraffe, and Dry creeks). These streams were to be sampled every other year. In 2006, as part of the BCT management plan (Teuscher and Capurso 2007), additional streams were added to the BCT monitoring program to implement a broader representation of BCT population trends from across their historical range in Idaho. These additional monitoring streams included Eightmile, Bailey, Georgetown, Beaver, Whiskey, Montpelier, Maple, Cottonwood, Snow slide, First, Second, and Third creeks, and the Cub River. In 2010, IDFG personnel determined that the monitoring program could be improved by dropping some sites and streams initiated in 2006, while adding other streams throughout the four BCT management units in the Bear River drainage (Figure 20). Currently, the monitoring program consists of three streams and eight sites in the Pegram Management Unit (PMU), six streams and 14 sites in the Nounan Management Unit (NMU), four streams and nine sites in the Thatcher Management Unit (TMU), four streams and eight sites in the Riverdale Management Unit (RMU), and three streams and six sites in the Malad Management Unit (MMU; Table 8). We will sample half of these streams annually. In addition, the monitoring program includes two segments of the main-stem Bear River in each of the management units. Mainstem Bear River segments in each management unit will be sampled every four years.

There are a number of variables that may influence BCT population trends including annual precipitation, water temperature, irrigation, grazing, etc. (Teuscher and Capurso 2007). Given the sensitive status of BCT and recent petitions to list the species under the Endangered Species Act, it is important to identify and correlate variation in BCT densities that appear to be associated with these and other suspected variables. Therefore in 2011, we collected a suite of habitat variables. The descriptions of these habitat variables and collection methods are listed in Table 9. In the future, habitat data will be correlated to variation in BCT abundance. Although, analysis of habitat variables require many years of data collection; therefore, no statistical analysis will be reported until sufficient data is collected.

We sampled at least two sites on each stream using multiple pass removal techniques with backpack electrofishing equipment to calculate mean BCT densities. At each site, a segment of stream (approximately 100 m) was sampled, which included block nets at the downstream and upstream boundaries. The area (m^2) sampled was calculated using length (m) and average width (m). We calculated a population estimate using MicroFish 3.0 software (MicroFish Software, Durham, NC, USA). Bonneville Cutthroat Trout percent composition was calculated by dividing the number of BCT by the total number of all salmonids sampled. Mean densities and percent composition for an entire stream was calculated across the mean values from each site within a stream. Relative weights (W_r) were calculated for individual fish using the standard weight equation developed for cutthroat trout (Kruse and Hubert 1997). Mean W_r for each stream was calculated across all individual relative weights.

Results and Discussion

In 2015, nine streams were sampled, which included seven sites within the RMU, nine sites in the TMU, and two sites within the MMU (Figure 20). The sites that we did not sample were due to either lack of landowner permission or water. Overall, mean BCT density was 3.6 fish/100 m^2 (±0.6 S.E; range 0.0 – 7.5). The highest BCT density was observed in Third Creek (7.5 fish/100 m^2) and all streams had BCT, but some sites within a stream did not. The percent composition of BCT relative to other salmonids sampled varied between streams. The percent composition of BCT was lowest in Whiskey Creek (54%) and the highest was observed in Stockton, Hoopes, and Third Creeks at 100% (Table 10). BCT densities for all the years that these streams have been sampled are illustrated in Figure 21 (RMU), Figure 22 (TMU), and Figure 23 (MMU).

Three streams (Beaver Creek, Logan River, and Hoopes Creek) showed an increase in BCT densities compared to those estimated in 2013. Stockton Creek had the same BCT densities as those estimated in 2013. All other streams showed a decrease in BCT densities (Table 10). Third Creek showed a substantial decrease in BCT densities from 27.2 in 2013 to only 3.8 in 2015.

MANAGEMENT RECOMMENDATIONS

1. Continue evaluation of Yellowstone Cutthroat Trout life history metrics.
2. Continue pelican predation work on the Blackfoot River system.
3. Continue Bonneville Cutthroat Trout monitoring.

TABLES

Table 1. Number, mean length (mm) and mean weight (g) of Largemouth Bass transferred to Johnson Reservoir, Idaho, from 2011-2014.

Year	Number	Length (mm)	Weight (g)
2011	114	380	726
2012	22	292	502
2013	33	378	805
2014	54	362	858

Table 2. Species composition and harvest regulations for reservoirs included in the 2015 Largemouth Bass surveys.

Water	Elevation (m)	Surface area (ha)	Species composition	Harvest regulations
Condie	1,500	47	LMB[a], BG[b], YP[c]	2 none under 20”
Lamont	1,485	37	LMB, BG, YP, RBT[d],CR[e]	6 none under 12”
Johnson	1,485	20	LMB, BG, YP, RBT	6 none under 12”
Winder	1,492	38	LMB, BG, YP, RBT	6 none under 12”

[a] Largemouth Bass.
[b] Bluegill.
[c] Yellow Perch.
[d] Rainbow Trout.
[e] Crappie.

Table 3. Catch-per-hour of electrofishing effort in five southeast Idaho reservoirs in 2013. Proportional Stock Density values for Largemouth Bass (LMB) and Bluegill (BG) are shown in parenthesis.

Species	Condie	Lamont	Johnson	Winder
LMB	120 (68)	205 (31)	171 (33)	62 (6)
BG	09 (80)	609 (30)	344 (35)	296 (47)

Table 4. Trends in Proportional Stock Density (PSD) for select Largemouth Bass populations in reservoirs of southeast Idaho. Values in parentheses were based on data obtained from Largemouth Bass fishing tournaments.

Year	Condie	Johnson	Glendale	Lamont	Winder
1986				13	
1987					
1988	30		9		10
1989					
1990					
1991					
1992				3	
1993	21		6	1	25
1994	58				
1995	(76)		(86)	1	
1996					
1997	(73)		(94)		
1998			83		
1999	43		(75)		
2000			(97)		
2001					
2002	97		56	8	0
2003	14				
2004					
2005			(100)		
2006	20		56	13	78
2008	90		23		
2010	36	12	84	8	
2011	57	26			33
2013	88	17	60	11	
2014		26			
2015	68	33		31	5

Table 5. Summary of gillnet data from Blackfoot Reservoir from 1963 to 2015.

Year	Nets	Total catch	RBT	YCT	Total trout	% Trout	UC	US	CP	YP	Total non-trout	% Non-Trout
1963	2					31						69
1964						25						75
1967	4	348			13	4					335	96
1968		270	15	4	19	8	122	129			251	92
1971	20	782	9	16	25	3	456	283	18		757	97
1980	12	865	16	19	35	4	556	272	2		830	96
1991		273	1	7	8	3	216	49			265	97
1997		389	6	6	12	3	351	22	4		377	97
1999	6	1,528	22	1	23	2	1,291	200	7	7	1,505	98
2001	12	954	17	5	22	2	748	101	15	51	932	98
2003	6	454	26	1	27	6	304	123			454	94
2004	8	648	3	3	6	1	528	113	1	2	648	99
2005	8	476	10	2	12	3	311	148	2	3	476	97
2009	8	973	82	3	85	9	590	235	47	16	973	91
2011	8	424	60	4	64	15	179	165	6	10	360	85
2012	8	225	33	0	33	15	80	97	15	0	192	85
2015	8	244	63	0	63	26	121	56	3	0	181	74

YCT = Yellowstone Cutthroat Trout, RBT = Rainbow Trout, UC = Utah Chub, US = Utah Sucker, YP = Yellow Perch, CP = Common Carp.

Table 6. Yellowstone Cutthroat Trout escapement estimates for the Blackfoot River 2001-2015. No escapement estimates are available in 2011 due to extremely high river discharge during the migration season which resulted in poor tapping efficiency.

Year	**Weir type**	**YCT count**	**Mean length(mm)**	**% Bird scars**	**Mean May river Q (cfs)**	**Adult pelican count**
2001	Floating	4,747	486	No data	74	No data
2002	Floating	902	494	0	132	1,352
2003	Electric	427	495	No data	151	1,674
2004	Electric	125	478	70	127	1,748
2005	Electric	16	Na	6	388	2,800
2006	Electric	19	Na	38	453	2,548
2007	Electric	98	445	15	115	3,416
2008	Electric	548	485	10	409	2,390
2009	Electric	865	484	14	568	3,174
2010	Electric	938	468	12	248	1,734
2011	Electric	Na	Na	Na	936	724
2012	Electric	530	483	37	200	3,034
2013	Electric	1,843	486	34	176	1,996
2014	Electric	807	487	24	302	2,096
2015	Electric	190	496	7	278	1,466

Table 7. Yellowstone Cutthroat Trout (YCT) population and density estimates collected from the Blackfoot River Wildlife Management Area of the Blackfoot River, Idaho.

Year	Fish Marked	Fish Captured	Fish Recaptured	% Recaptured	Pop. Estimate	Pop. Estimate SD	Density YCT / Km
2005	266	202	20	7.5	3,664	569.1	421
2006	339	450	57	16.8	3,534	352.3	406
2008	223	186	28	12.6	2,504	336.5	288
2009	279	319	44	15.8	2,567	286.5	494
2010	317	272	11	3.5	12,944	4,131.2	2,489
2011	318	147	16	5.0	3,222	411.3	620
2012	137	99	12	12.1	1,672	421.7	322
2013	65	N/A	N/A	N/A	N/A	N/A	N/A
2014[b]	137	130	12	9.2	2,147	417.9	413
2015	149	119	14	11.8	3,659	593.9	704
Mean[a]	231	207	25	11	2,871	423.65	458

[a] Excludes 2010 and 2013.
[b] Excludes adfluvial fish >400 mm.

Table 8. The 20 monitoring streams and number of sites within the five BCT management units, including the length (km) of stream sampled, total stream length (km), and the percent of stream sampled.

Management unit	Stream	Sites	Stream sampled (km)	Stream length (km)	% sampled
Pegram	Dry Ck.	2	0.2	13.4	1.5
	Giraffe Ck.	2	0.2	5.7	3.5
	Preuss Ck.	4	0.4	22.0	1.8
	Bear River	2	17.2	61.2	28.1
Nounan	Bailey Ck.	2	0.2	9.9	2.0
	Eightmile Ck.	3	0.3	23.6	1.3
	Georgetown Ck.	3	0.3	21.8	1.4
	Montpelier Ck.	2	0.2	36.0	0.6
	Pearl Ck.	2	0.2	5.3	3.8
	Stauffer Ck.	2	0.2	14.5	1.4
	Bear River	2	18.8	94.5	19.9
Thatcher	Cottonwood Ck.	3	0.3	37.4	0.8
	Hoopes Ck.	2	0.2	13.5	1.5
	Trout Ck.	2	0.2	18.3	1.1
	Whiskey Ck.	2	0.2	5.1	3.9
	Bear River	2	18.0	37.8	47.6
Riverdale	Beaver Ck.	2	0.2	13.7	1.5
	Logan R.	2	0.2	4.7	4.3
	Maple Ck.	3	0.3	16.1	1.9
	Stockton Ck.	2	0.2	9.8	2.0
	Bear River	2	13.6	50.2	27.1
Malad	First Ck.	2	0.2	9.0	2.2
	Second Ck.	2	0.2	8.4	2.4
	Third Ck.	2	0.2	11.2	1.8

Table 9. List of habitat variables, units of measurement and collection methods for habitat characteristics used to explain variation in BCT abundance estimates.

Habitat variable	Unit of measurement	Collection methods
Water Temperature	Celsius	Measured at beginning of survey with handheld thermometer to the nearest ± 0.5 (°C).
Conductivity	µs/cm	Measured at beginning of survey with conductivity meter to the nearest ± 0.1 (µs/cm).
Discharge	ft^3/sec	Measured stream discharge with Rickly discharge meter in a uniform stream segment, using methods proposed by Harrelson et al. (1994)
Gradient	Percent	Gradient was calculated using aerial imagery by calculating the difference in water elevation from an upstream location to a downstream location that was greater than 50 meters apart.
Stream Width	Meters	Measure the wetted width (± 0.1 m) of the stream at ten (10) equally spaced transects within the survey reach and then calculate the mean reach width.
Stream Depth	Centimeters	At ten (10) equally spaced transects, measure and sum the depth (± 1 cm) of the stream at ¼, ½, and ¾ distance across the channel and divide by four. Use these values to calculate the mean reach depth.
Width/Depth Ratio	Meters	Convert the mean reach depth into meters. Divide the mean reach width by the mean reach depth.
Percent Stable Banks	Percent	At the ten (10) equally spaced transects, determine and circle if the bank on the left and right are stable using the following definition. Streambank is stable if they DO NOT show indications of alteration such as breakdown, erosion, tension cracking, shearing, or slumping (Burton et al. 1991).
Total Cover	Percent	Followed instructions from the streambank cover form in Bain and Stevenson (1999).
Canopy	Percent	Used a spherical densiometer and followed the methods of Platts et al. (1987).

Table 10. Descriptive values of Bonneville Cutthroat Trout population trends for the Riverdale, Thatcher and Malad Management Units.

Management Unit	Stream	Year	Sites	BCT / 100 m² Mean	BCT / 100 m² +/- 1 SE	% Comp	Mean Rel. Wt. (W_r)
Riverdale	Beaver Ck.	2006	3	6.0	2.6	45	88
		2009	3	1.3	0.5	26	89
		2011	2	0.6	0.3	19	102
		2013	2	0.8	0.5	89	89
		2015	2	5.7	0.1	77	100
	Logan R.	2001	1	16.4	N/A	100	
		2009	1	13.9	N/A	92	95
		2011	2	14.2	2.8	99	103
		2013	1	4.8	N/A	93	105
		2015	1	5.2	N/A	90	
	Maple Ck.	2001	2	3.3	1.2	100	
		2006	2	9.0	3.0	100	83
		2009	3	10.9	2.8	98	88
		2011	2	11.0	1.3	100	93
		2013	2	8.2	1.2	99	95
		2015	2	3.9	1.5	85	102
	Stockton Ck.	2010	2	8.0	5.0	97	90
		2011	2	5.4	2.6	100	97
		2013	2	4.0	2.7	100	108
		2015	2	4.0	2.7	100	82
Thatcher	Cottonwood Ck.	2006	3	3.5	2.1	100	90
		2007	2	19.0	9.0	100	97
		2008	2	12.8	10.3	92	92
		2011	3	11.4	4.6	97	86
		2013	2	8.3	0.1	85	89
		2015	3	3.4	1.7	99	86
	Hoopes Ck.	2011	2	0.9	0.2	100	93
		2015	1	4.4	N/A	100	112
	Trout Ck.	2007	1	0.0	N/A	0	
		2011	2	2.0	2.0	42	91
		2013	1	9.7	N/A	91	86
		2015	2	2.4	2.4	64	82
	Whiskey Ck.	2006	1	0.0	N/A	0	
		2011	2	0.1	0.1	4	
		2013	2	1.5	1.0	43	75
		2015	2	0.7	0.4	54	85
Malad	Third Ck.	2000	2	3.2	1.0	100	
		2006	2	1.0	1.0	100	
		2010	3	1.7	0.9	100	81
		2011	2	23.0	1.3	97	88
		2013	2	27.2	23.2	100	82
		2015	2	3.8	3.8	100	80

FIGURES

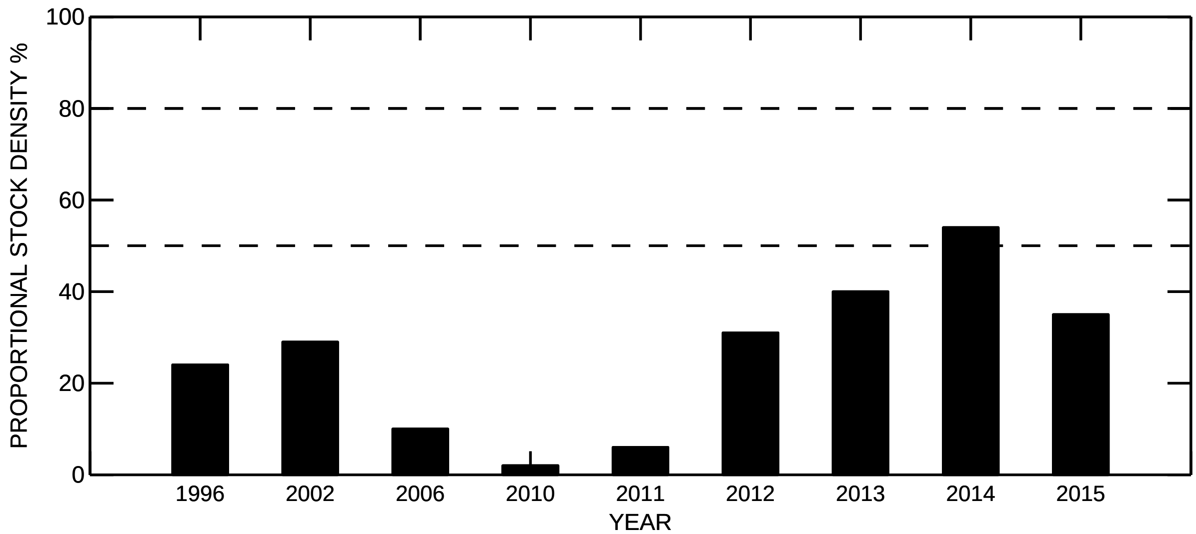

Figure 1. Proportional Stock Densities (PSD) of Bluegill collected from Johnson Reservoir, Idaho, over the past 19 years. The area between the horizontal dashed lines represents the ideal range of Bluegill PSD.

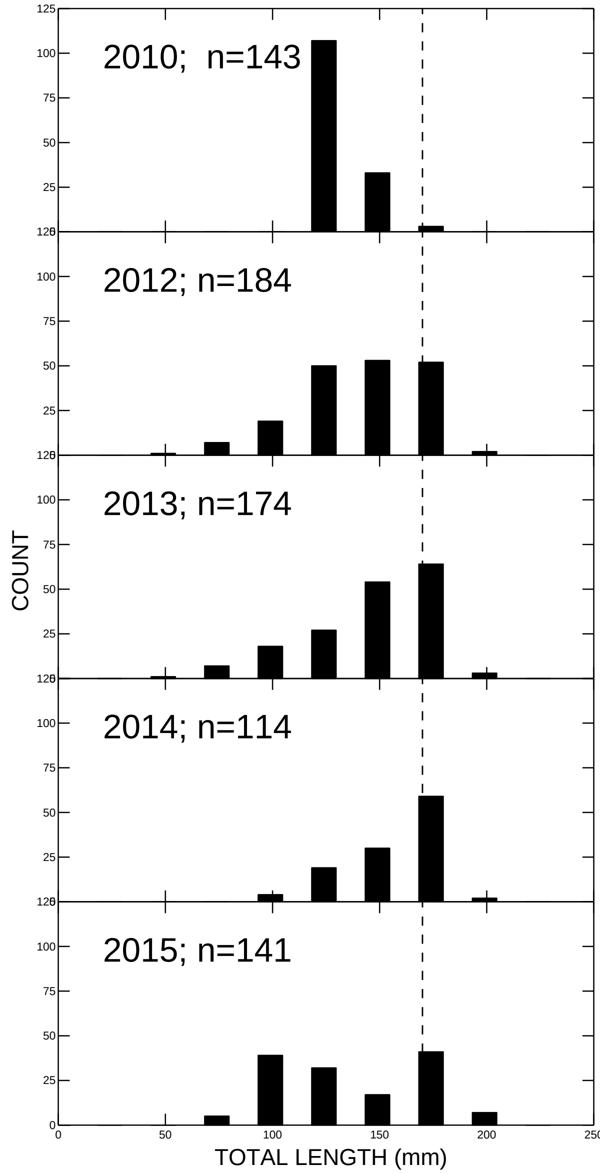

Figure 2. Length frequency histograms for Bluegill collected from Johnson Reservoir, Idaho. Data presented from 2010 represents the historical condition of the Bluegill fishery prior to implementation of the Largemouth Bass enhancement project.

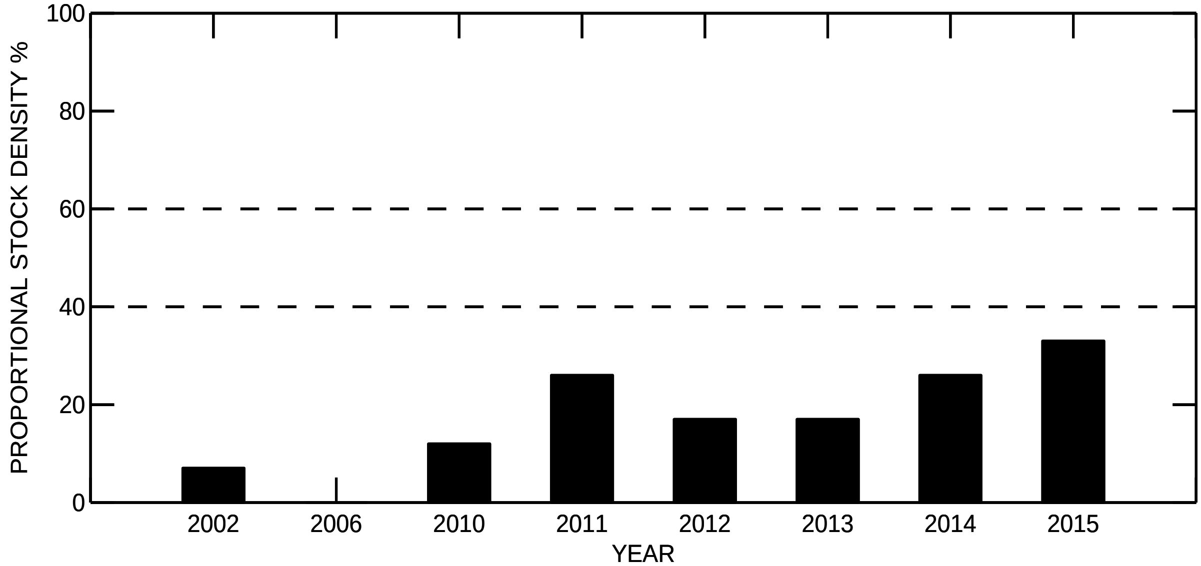

Figure 3. Proportional stock densities (PSD) of Largemouth Bass collected from Johnson Reservoir, Idaho. The area between the horizontal dashed lines represents the ideal range of Largemouth Bass PSD.

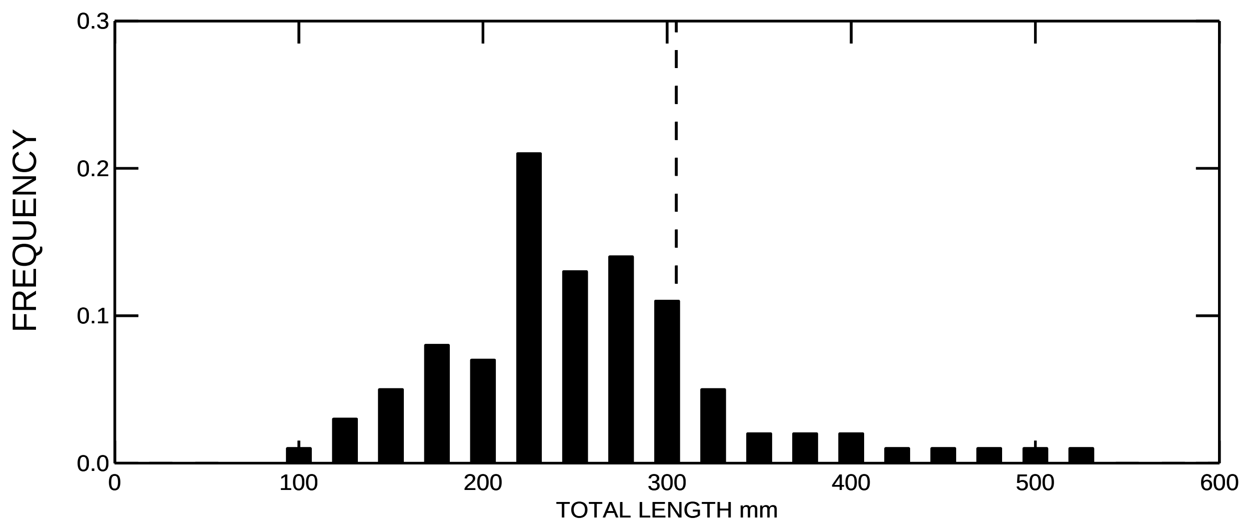

Figure 3. Relative length frequency distribution of Largemouth Bass collected from Johnson Reservoir, Idaho, in 2010-2015. The vertical dashed line at 305 mm (12 inches) represents when Largemouth Bass can be legally harvested.

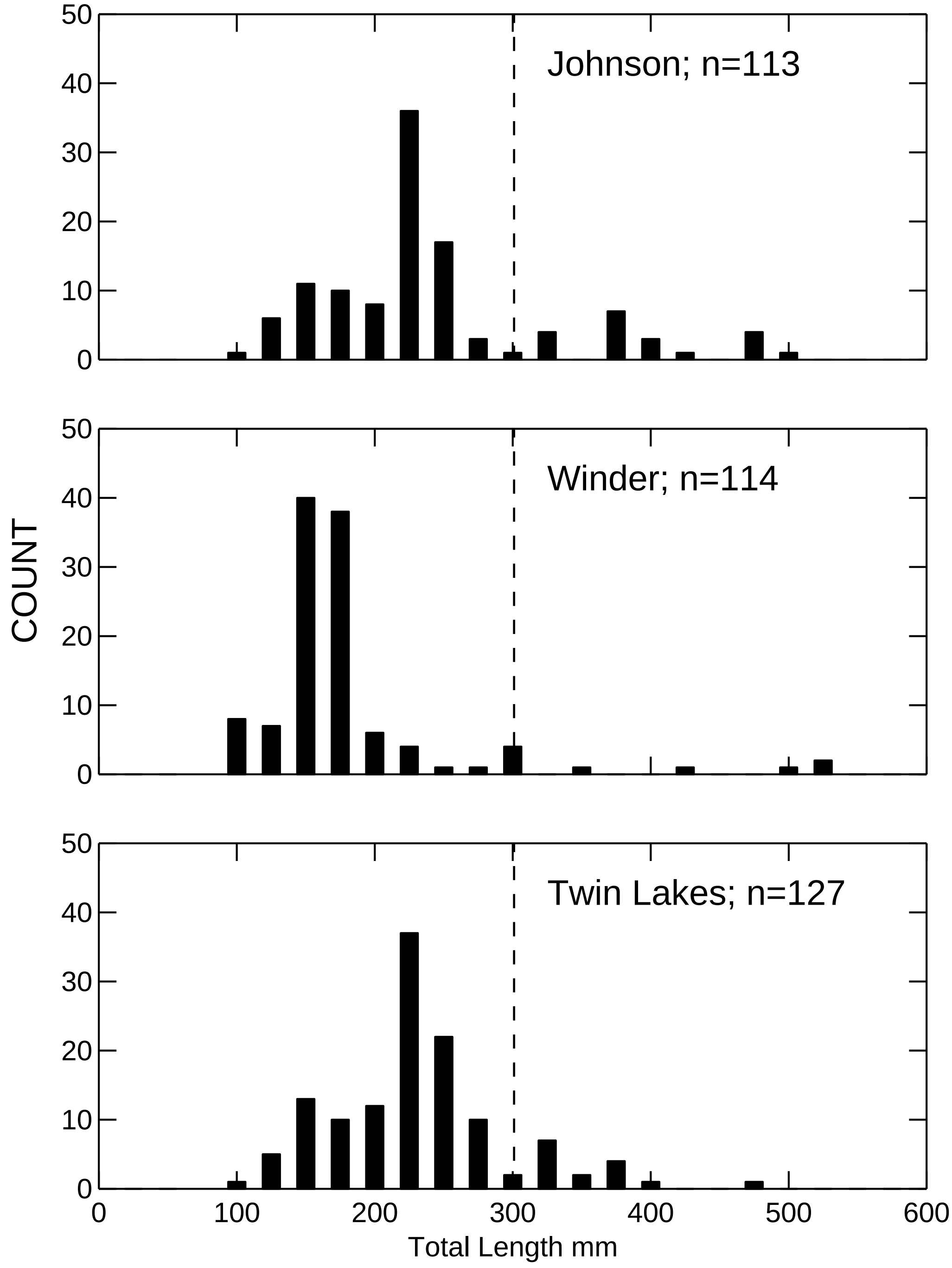

Figure 4. Length frequency histograms of Largemouth Bass (LMB) collected from three Southeast Idaho reservoirs in 2011. All waters are managed under general fishing regulations. The vertical dashed line indicates when LMB can be legally harvested.

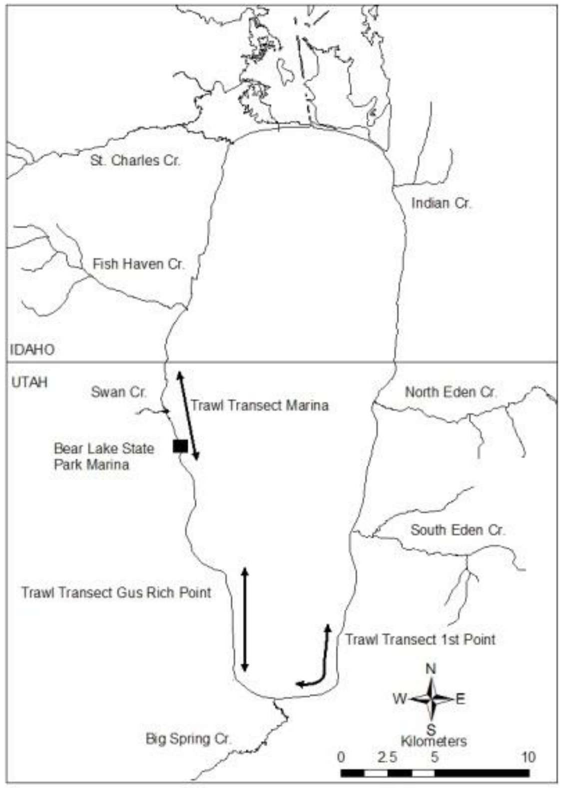

Figure 5. Locations within Bear Lake, Idaho/Utah, where Bear Lake Sculpin were sampled via bottom trawl in 2015.

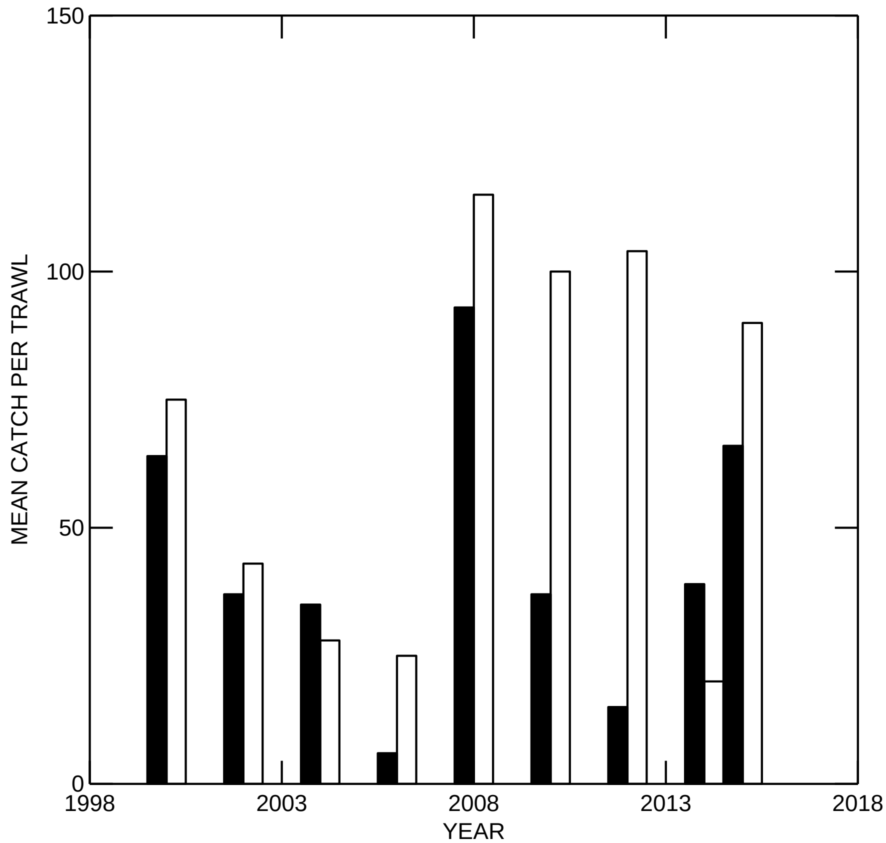

Figure 6. Mean Bear Lake Sculpin catch per trawl. Black bars represent samples collected from the top of the thermocline where it intersected with the lakebed (10 m) and the white bars represent samples collected from the bottom of the thermocline where it intersected with the lakebed (19 m). All trawls were 20 minutes in duration.

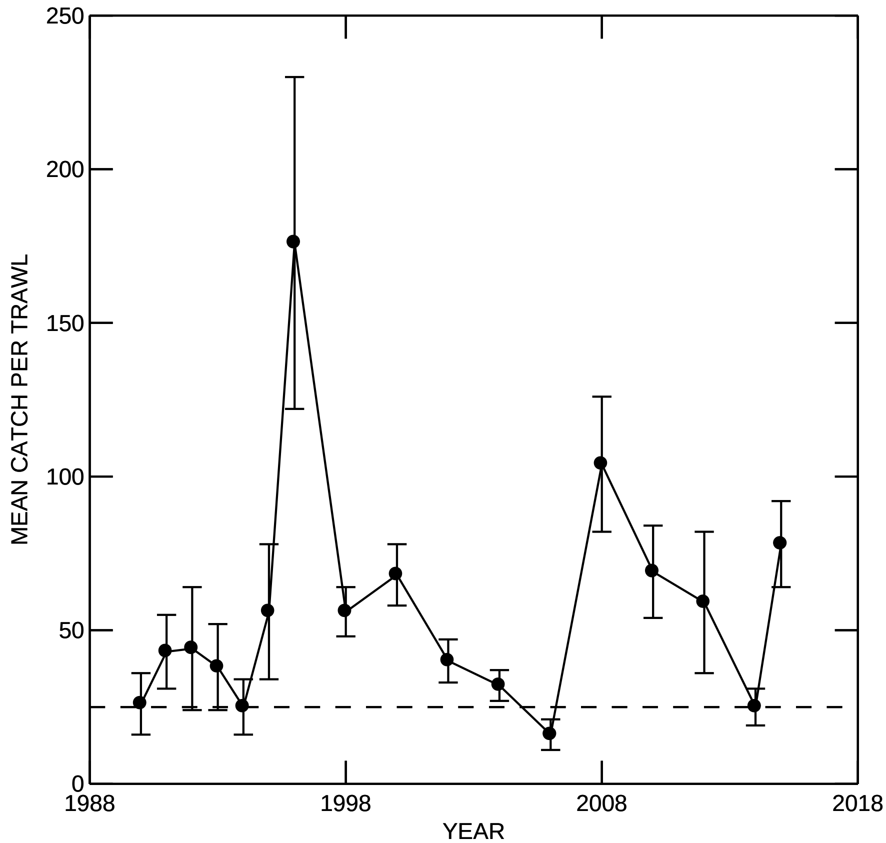

Figure 7. Mean catch (●) and standard error (I) per trawl for Bear Lake Sculpin collected from Bear Lake Idaho/Utah. Each trawl was 20 minutes in duration. The horizontal dashed line represents the minimum acceptable Bear Lake Sculpin population of 1 million as defined in the Bear Lake Management Plan (Tolentino and Teuscher 2010).

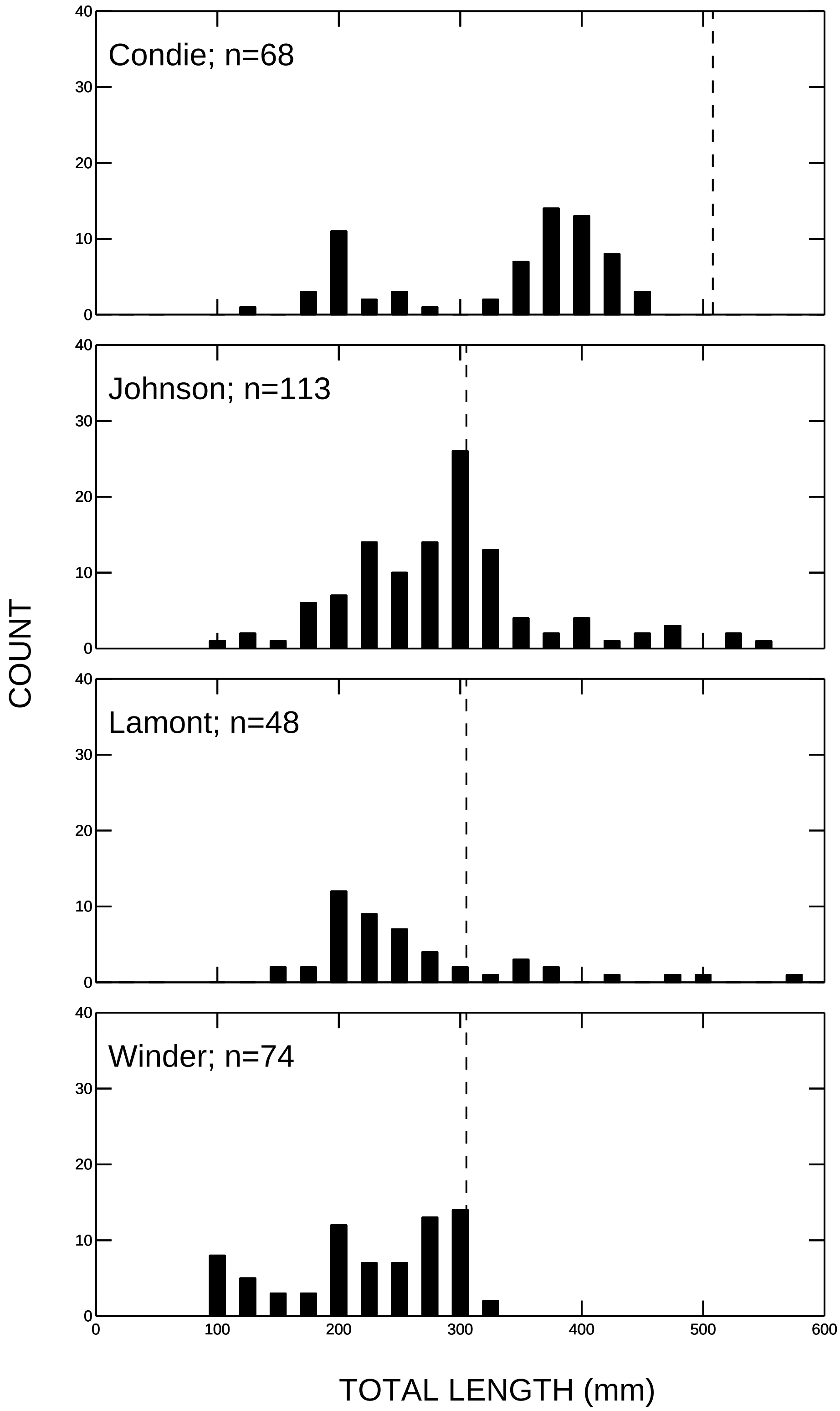

Figure 8. Largemouth Bass length frequency distributions collected from four southeast Idaho reservoirs in 2015. The vertical dashed lines represent the minimum length for legal harvest.

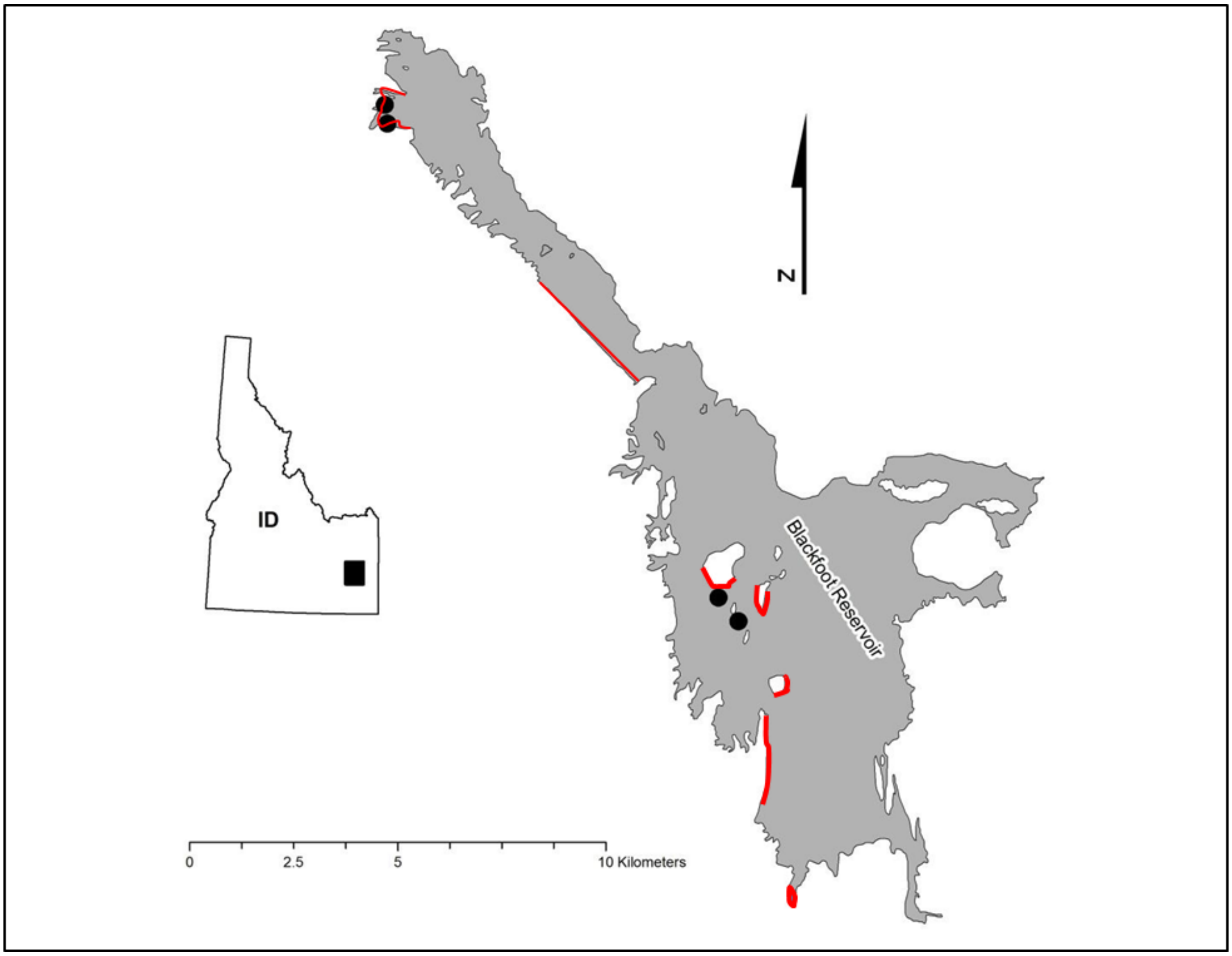

Figure 9. Locations where gillnets were set (●) and where electrofishing occurred (▬) at Blackfoot Reservoir, Idaho, during the summer of 2015.

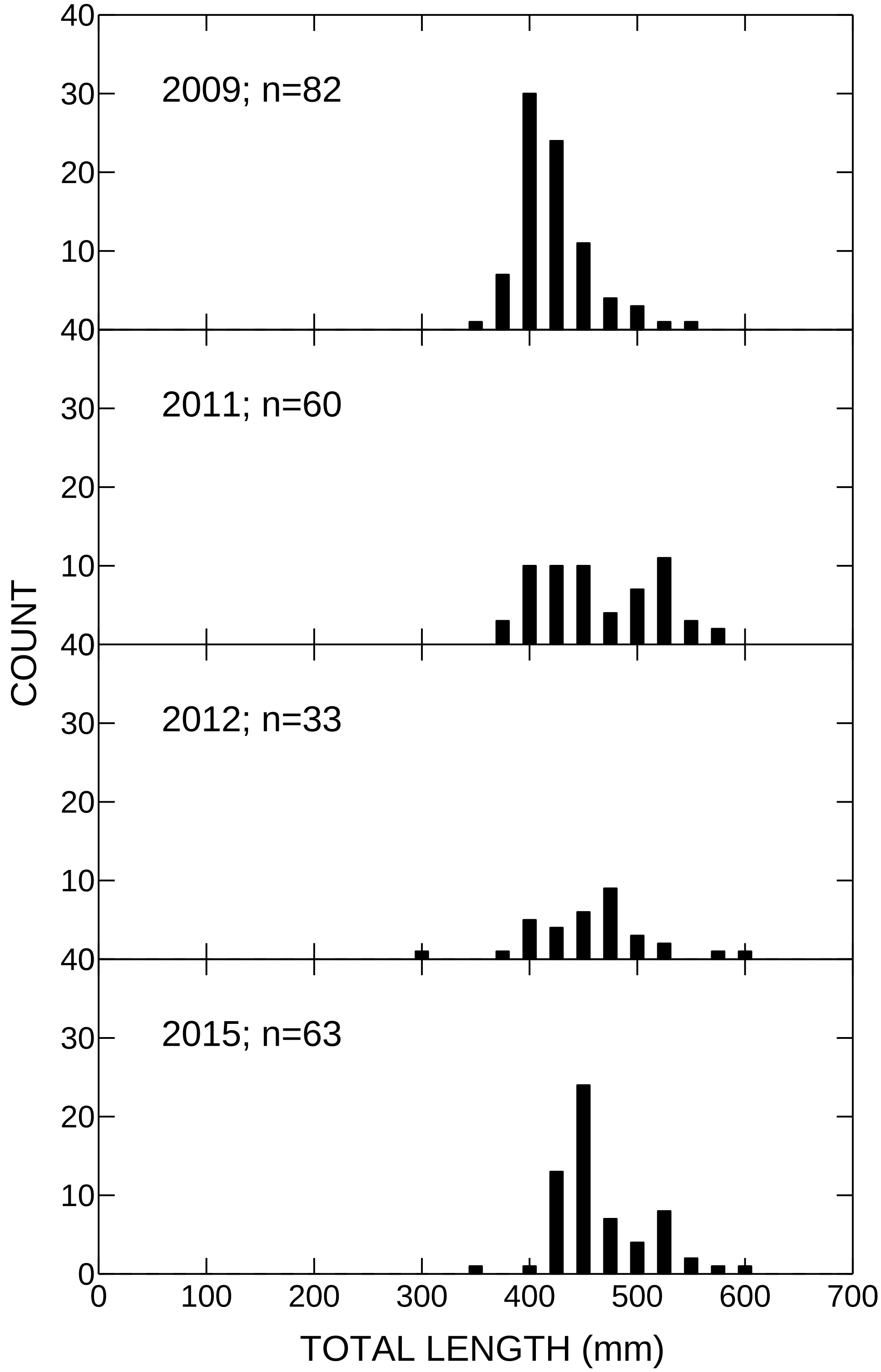

Figure 10. Length frequency of Rainbow Trout collected from Blackfoot Reservoir, Idaho, during the summers of 2009, 2011, 2012, and 2015.

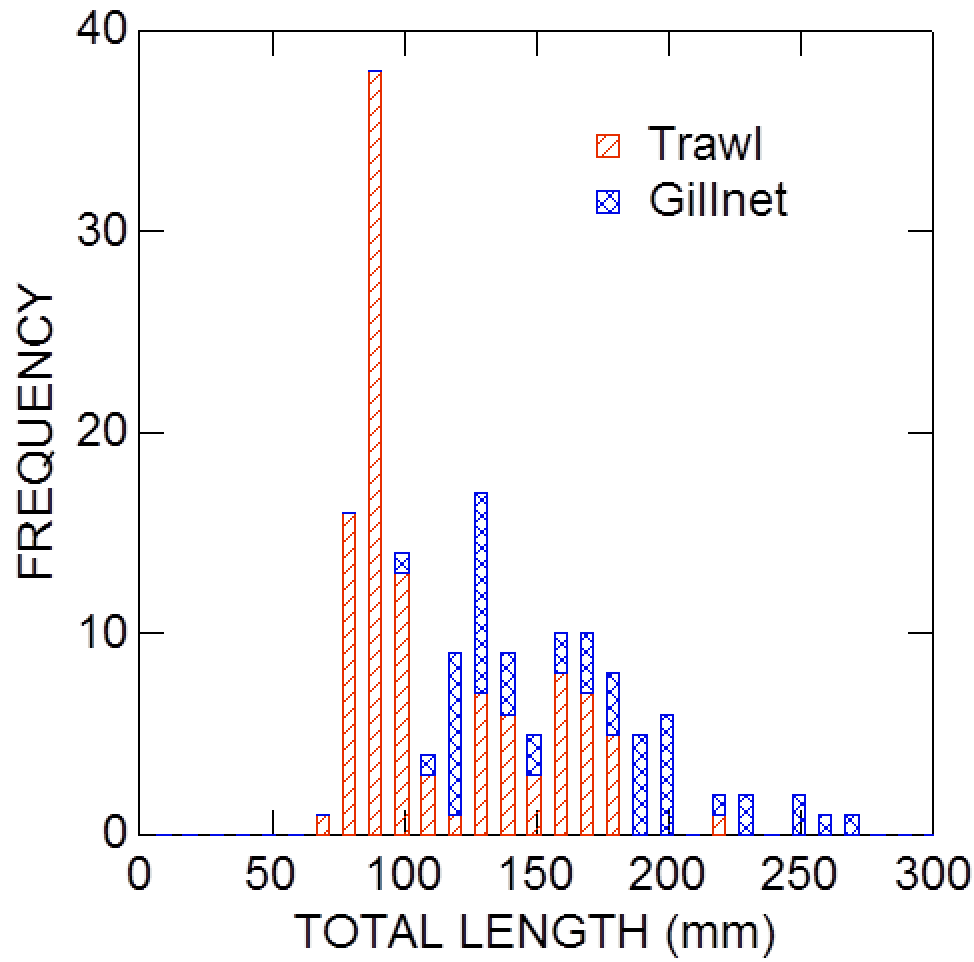

Figure 11. Length frequency distribution for Yellow Perch caught in the otter trawl and gill nets on Blackfoot Reservoir in 2001.

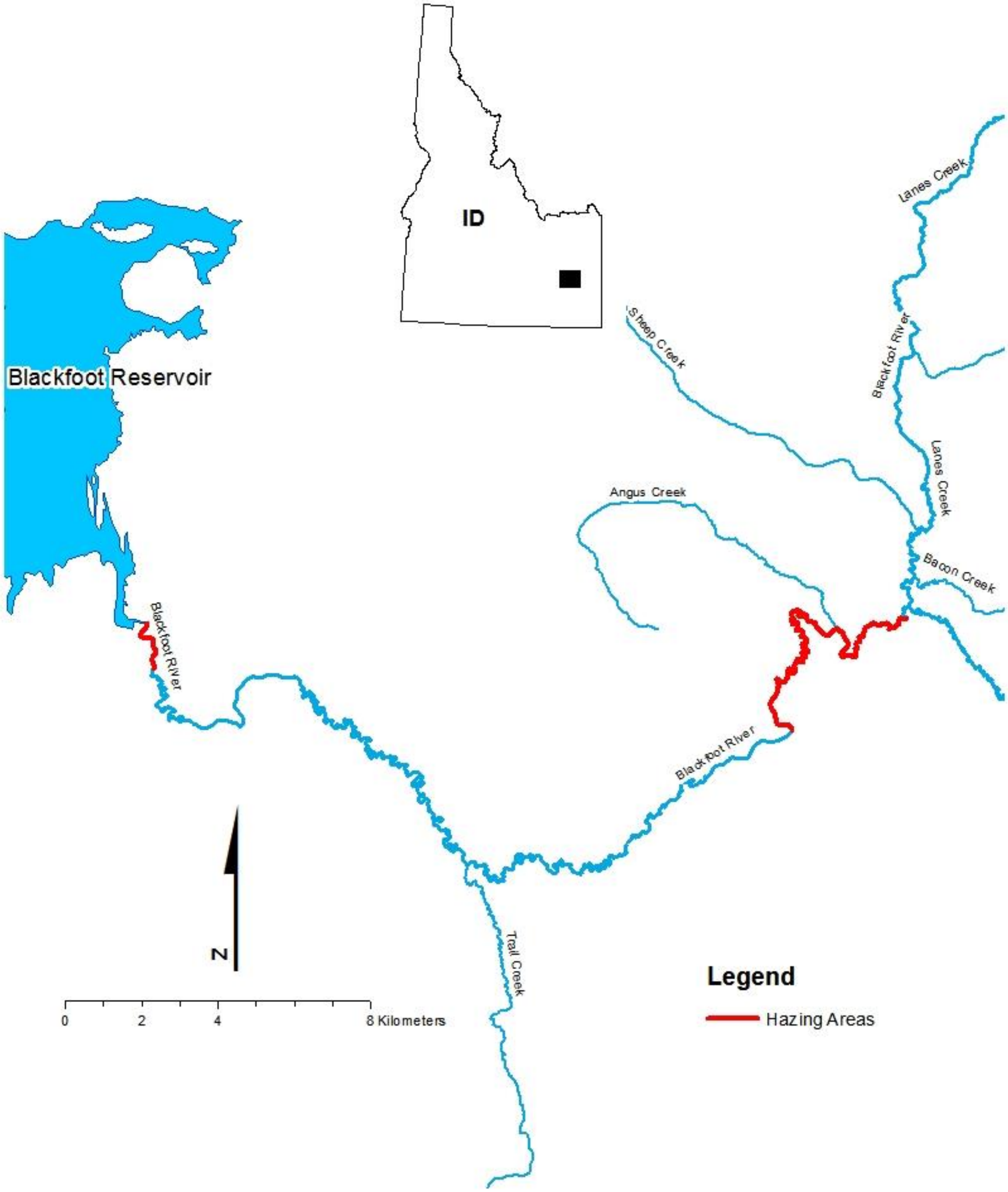

Figure 12. Locations where hazing and lethal take of American White Pelicans occurred on the upper Blackfoot River, Idaho, 2013-2015.

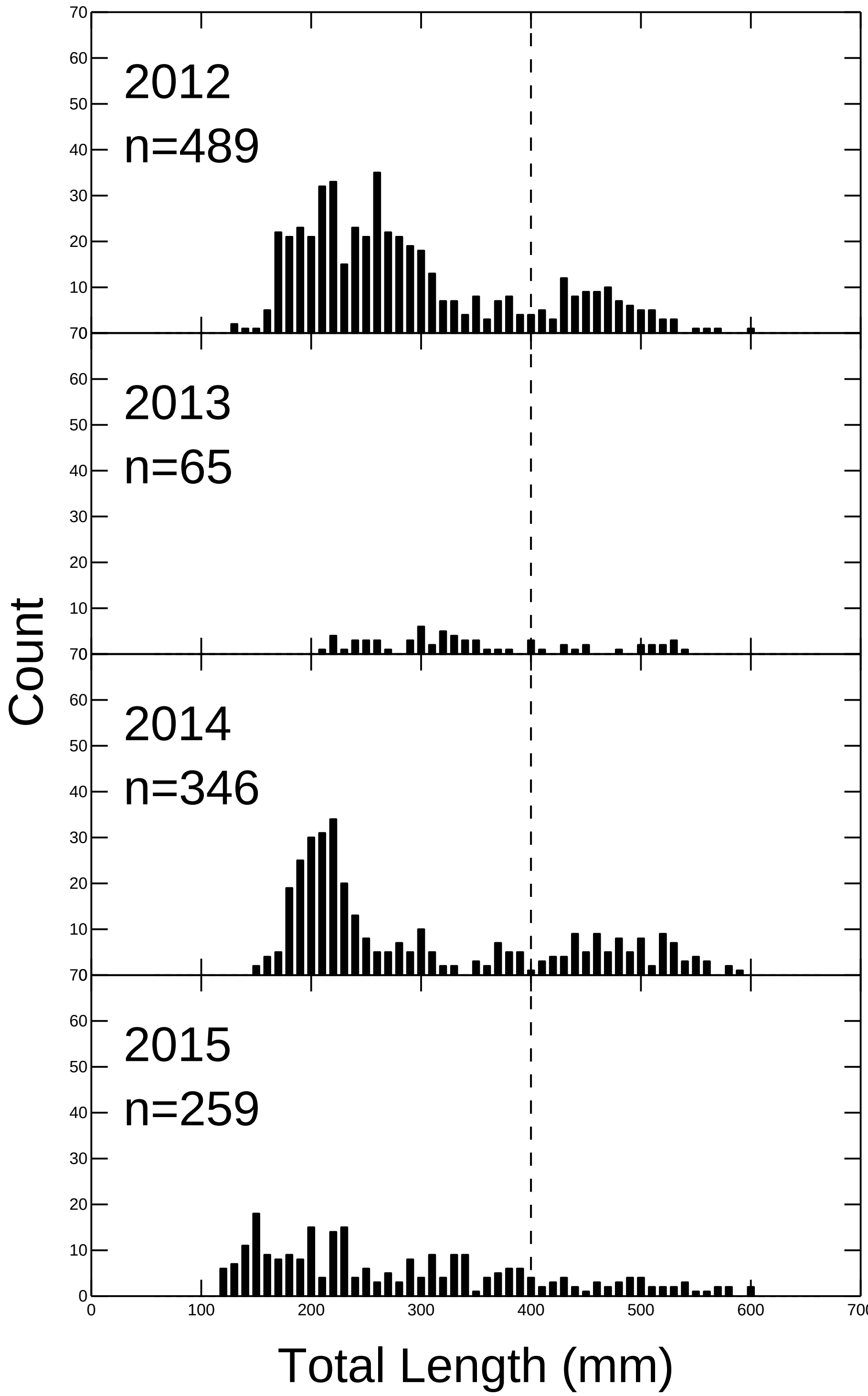

Figure 13. Length frequency distributions of Yellowstone Cutthroat Trout caught from the Blackfoot River Wildlife Management Area of the Blackfoot River, Idaho. The majority of fish located to the right of the vertical dashed lines are likely post spawn adfluvial fish that may return to Blackfoot Reservoir.

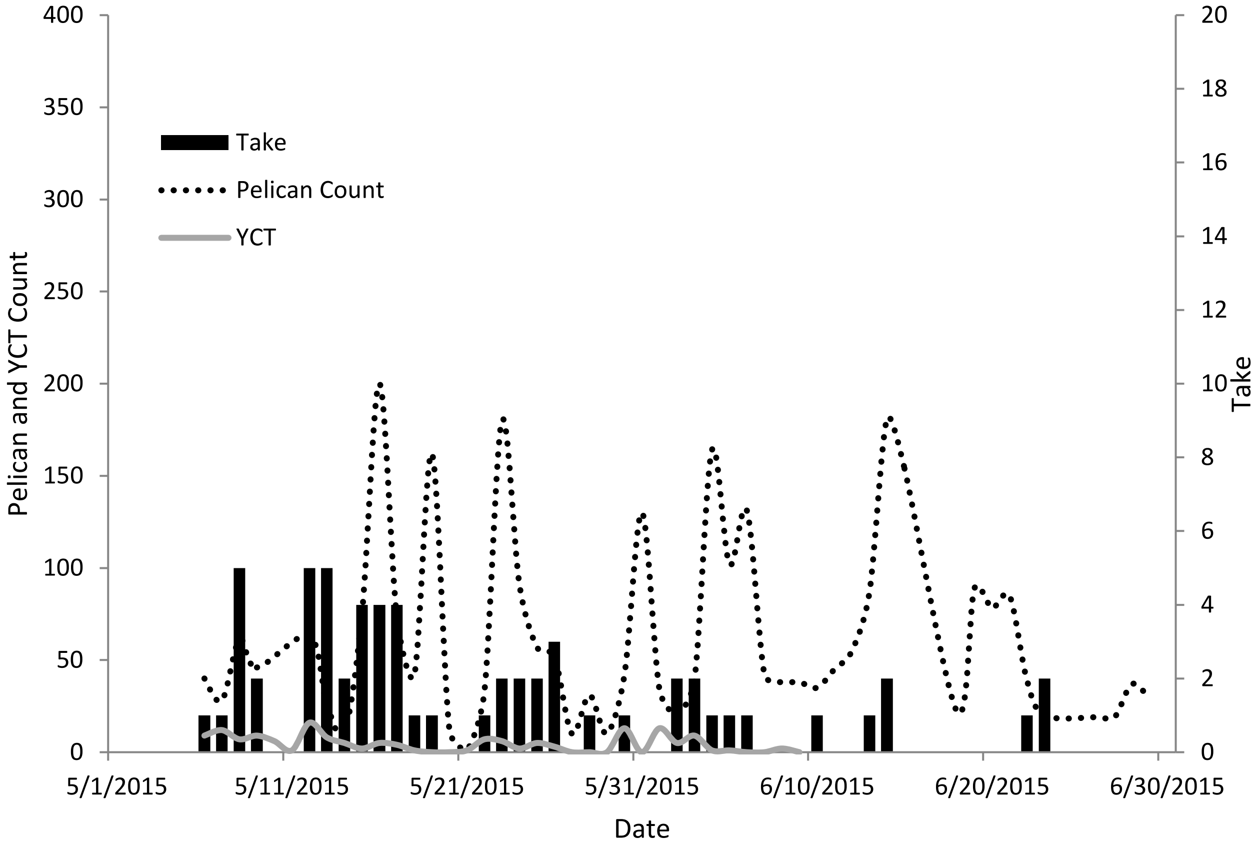

Figure 14. Numbers of Yellowstone Cutthroat Trout (YCT) and American White Pelicans observed on the upper Blackfoot River, Idaho, during 2015. Lethal take of American White Pelicans is also reported.

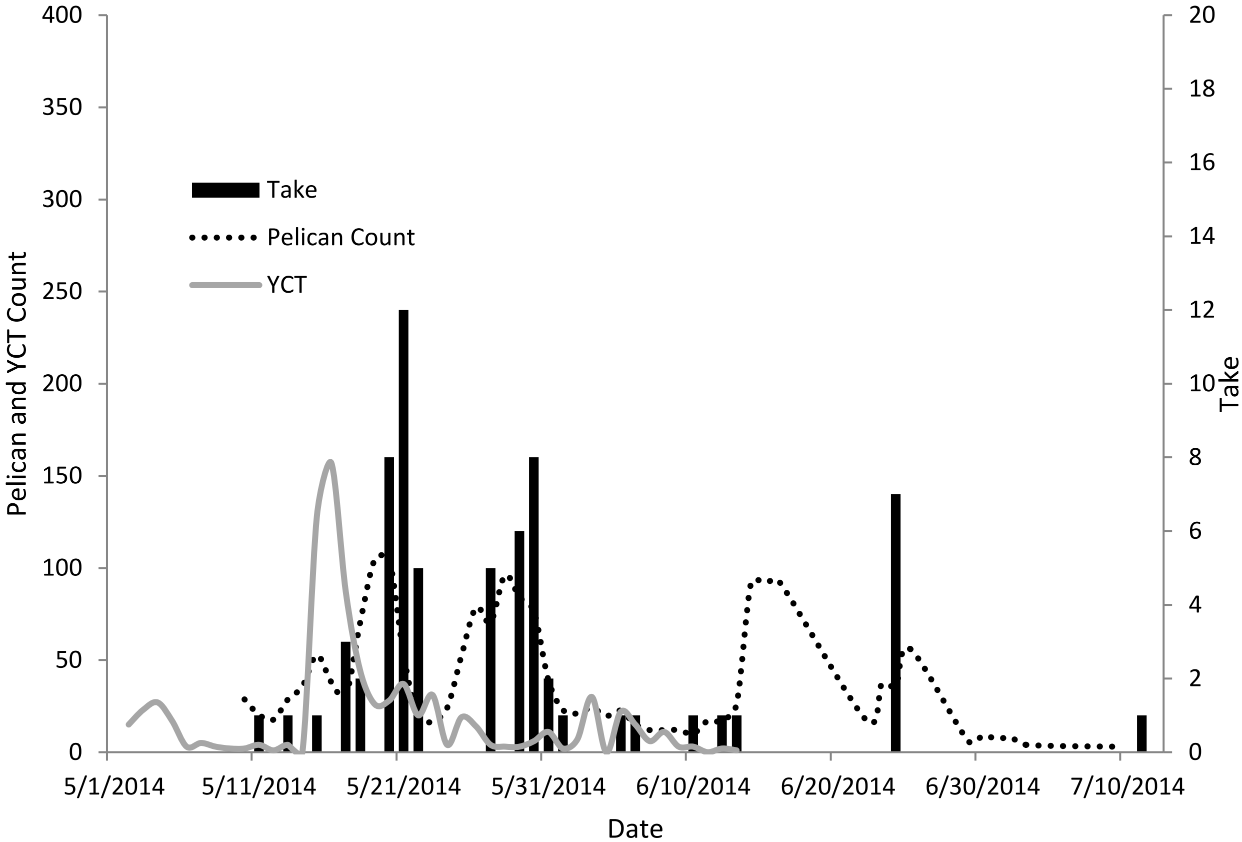

Figure 15. Numbers of Yellowstone Cutthroat Trout (YCT) and American White Pelicans observed on the upper Blackfoot River, Idaho, during 2014. Lethal take of American White Pelicans is also reported.

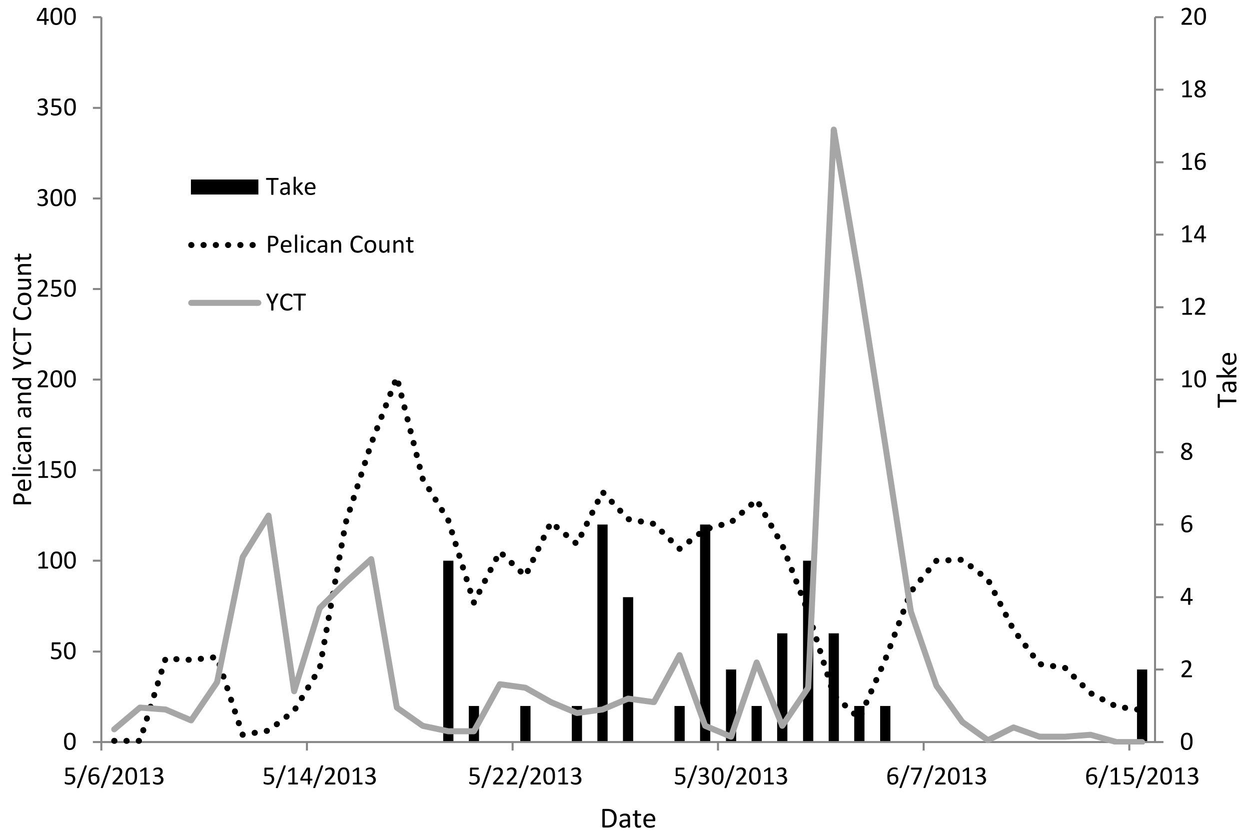

Figure 16. Numbers of Yellowstone Cutthroat Trout (YCT) and American White Pelicans observed on the upper Blackfoot River, Idaho, during 2013. Lethal take of American White Pelicans is also reported.

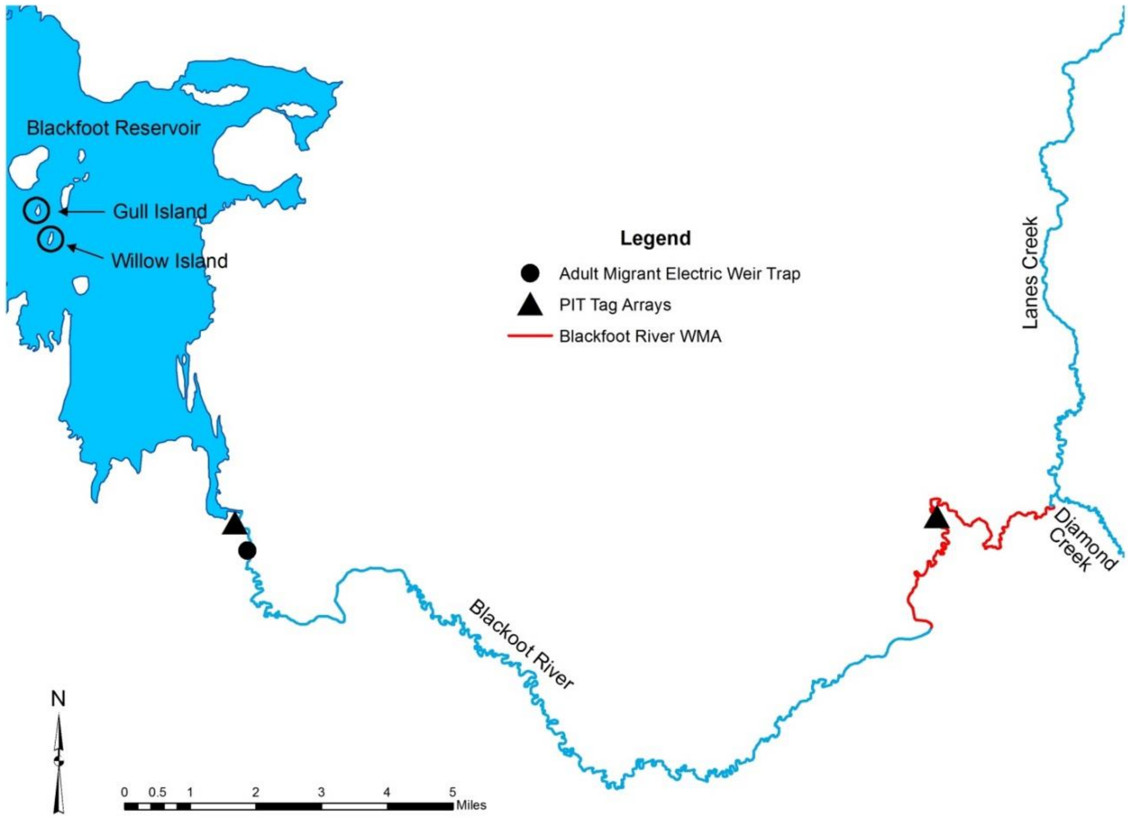

Figure 17. Locations where Yellowstone Cutthroat Trout were PIT tagged (adult migrant electric weir trap; Blackfoot River WMA) and subsequently detected (adult migrant electric weir trap; PIT tag arrays) on the upper Blackfoot River, Idaho from 2010-2015.

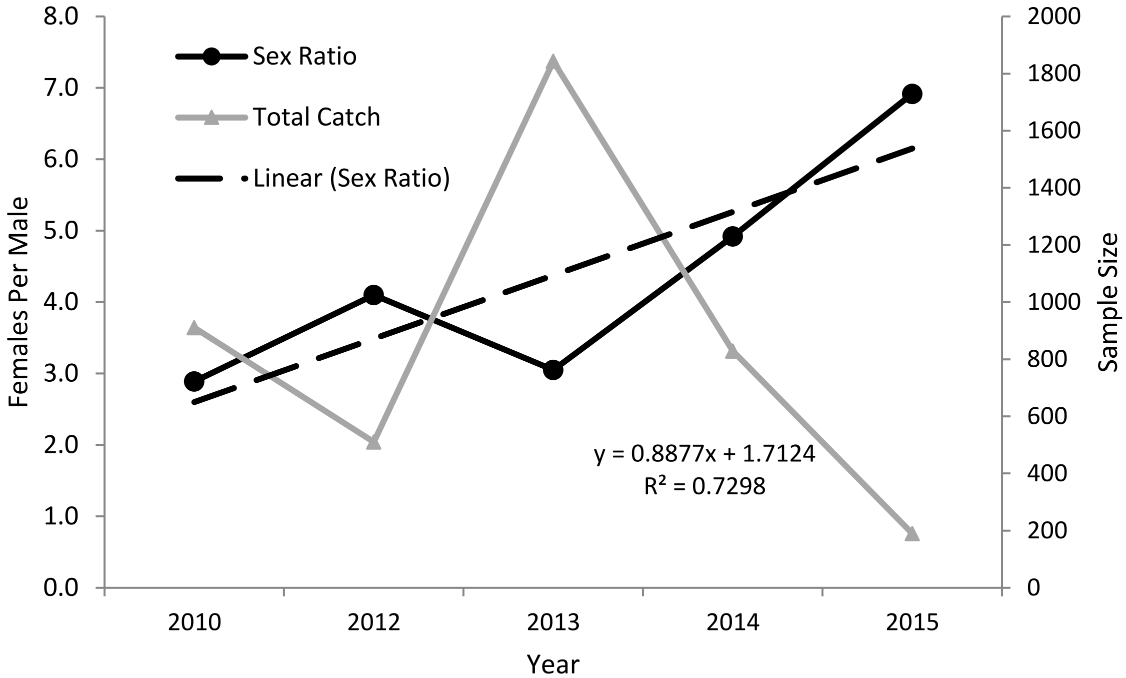

Figure 18. Sex ratios (females per male) of adult Yellowstone Cutthroat Trout collected from the upper Blackfoot River, Idaho, from 2010-2015.

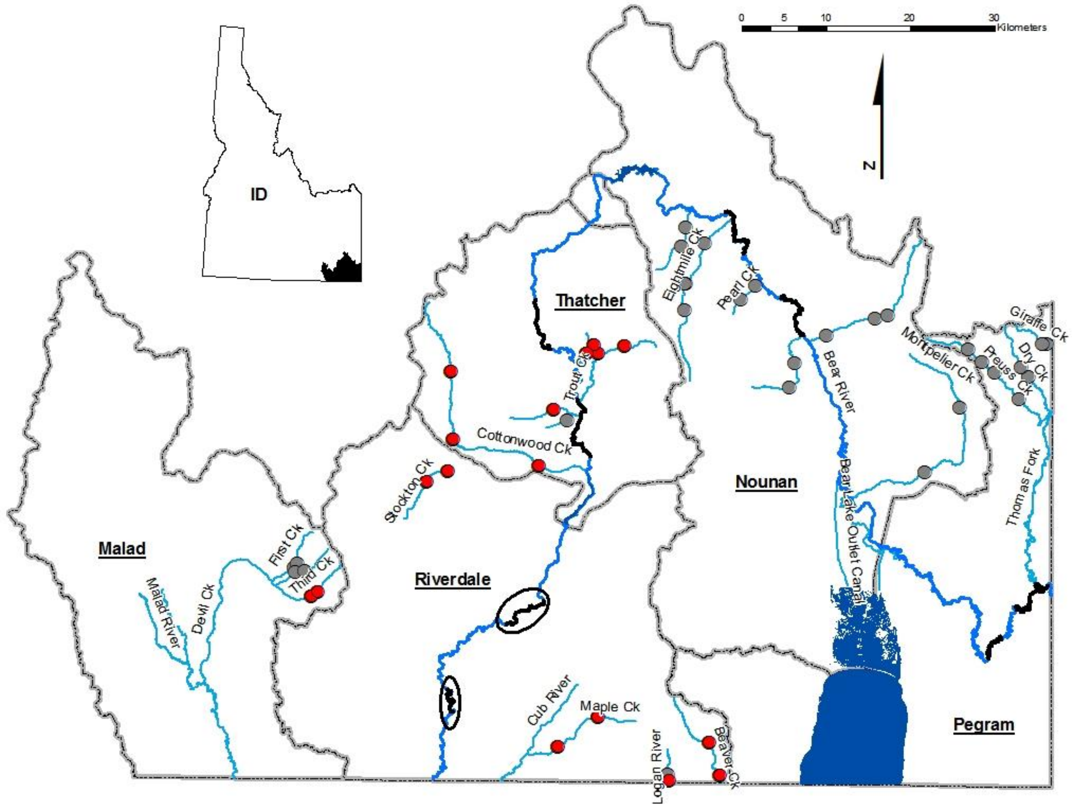

Figure 19. Map of the Bear River watershed in Idaho, including the five Bonneville Cutthroat Trout management units. The gray circles represent monitoring sites and red circles represent sites that were sampled in 2015. The black line segments on the main-stem Bear River represent monitoring reaches. The two main-stem monitoring reaches that are circled in the Riverdale Management Unit were sampled in 2015.

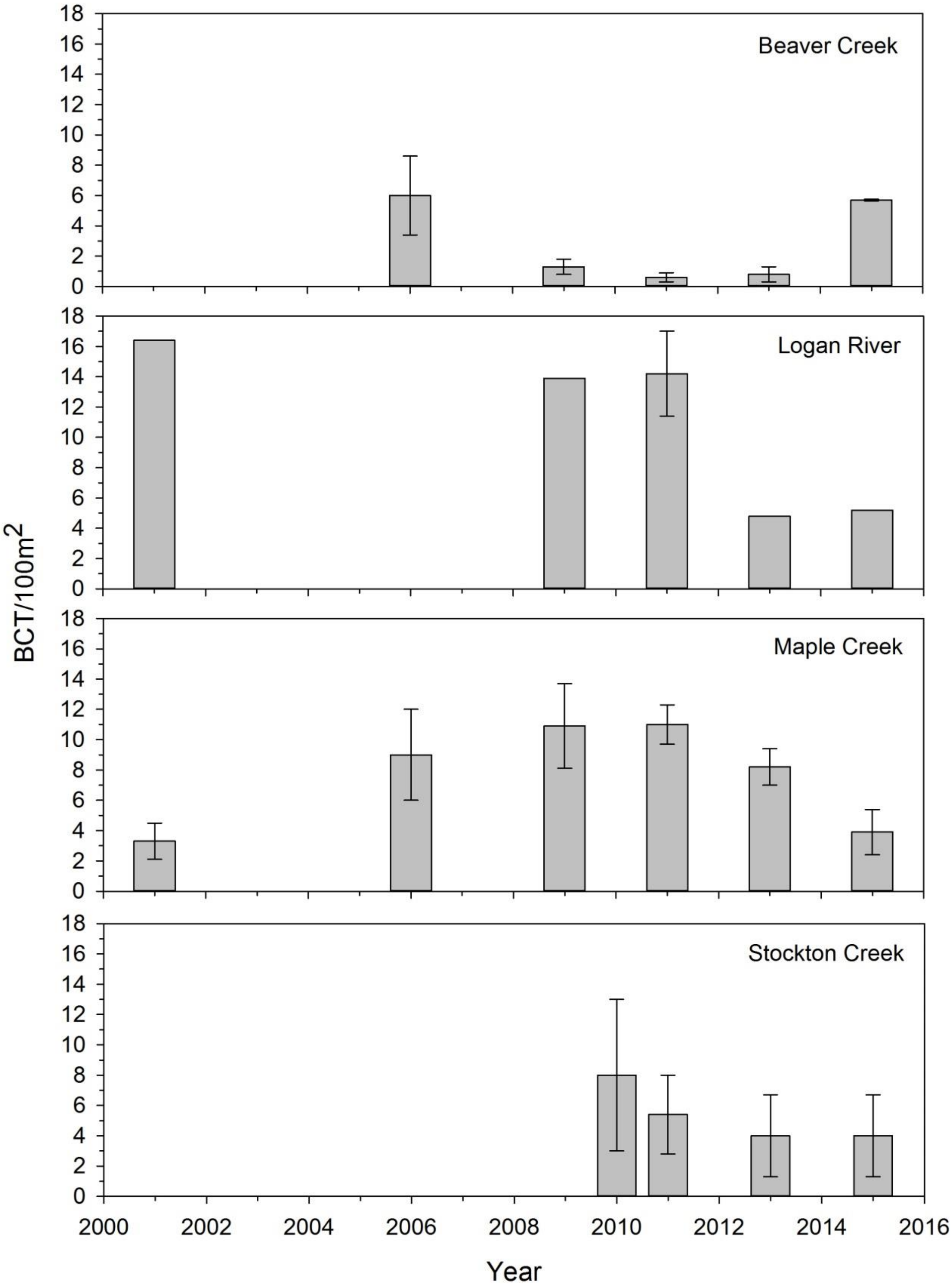

Figure 20. Average BCT density (fish/100 m^2) trends from 2001 to 2015 in the Riverdale Management Unit.

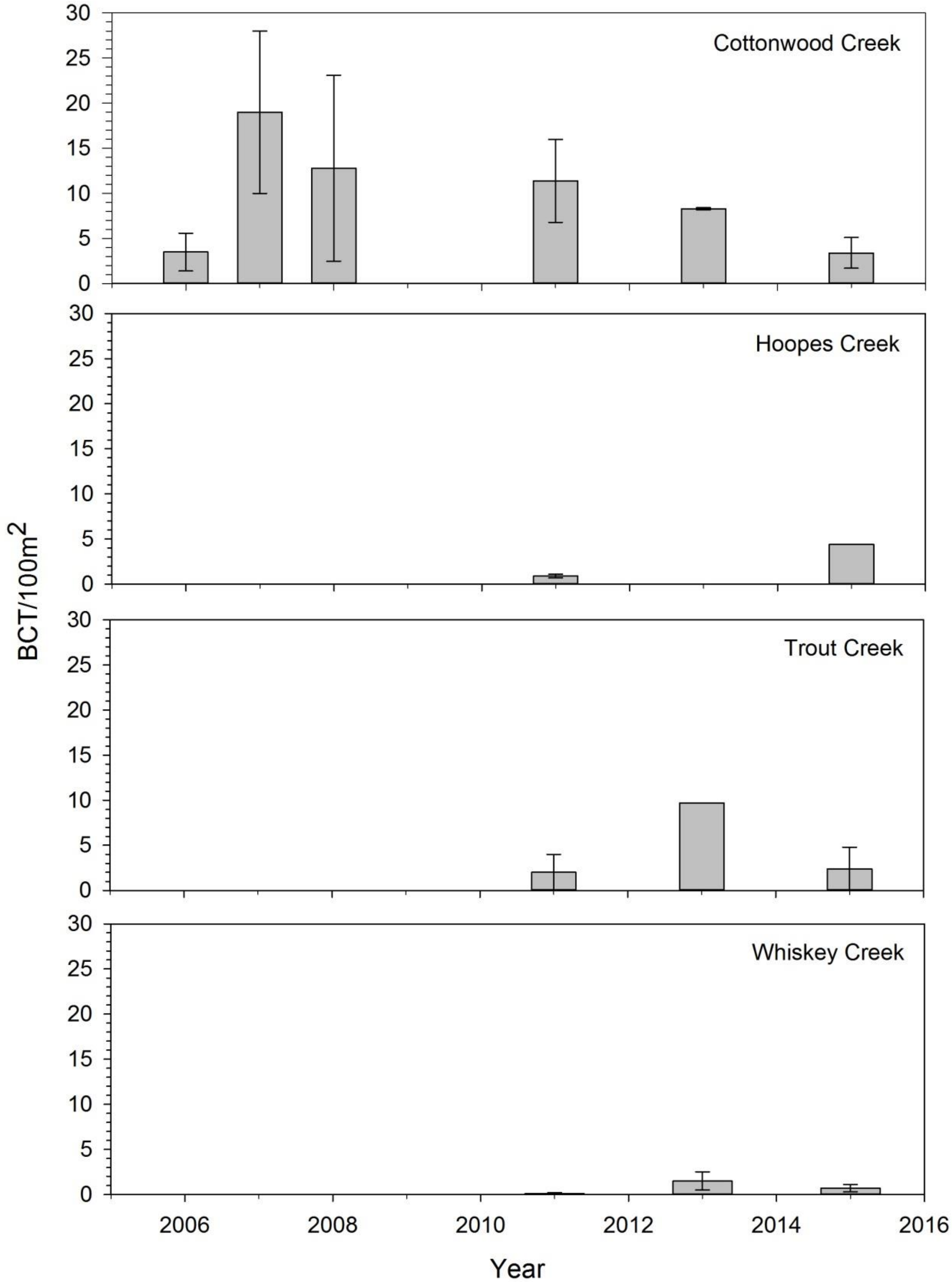

Figure 21. Average BCT density (fish/100 m^2) trends from 2006 to 2015 in the Thatcher Management Unit.

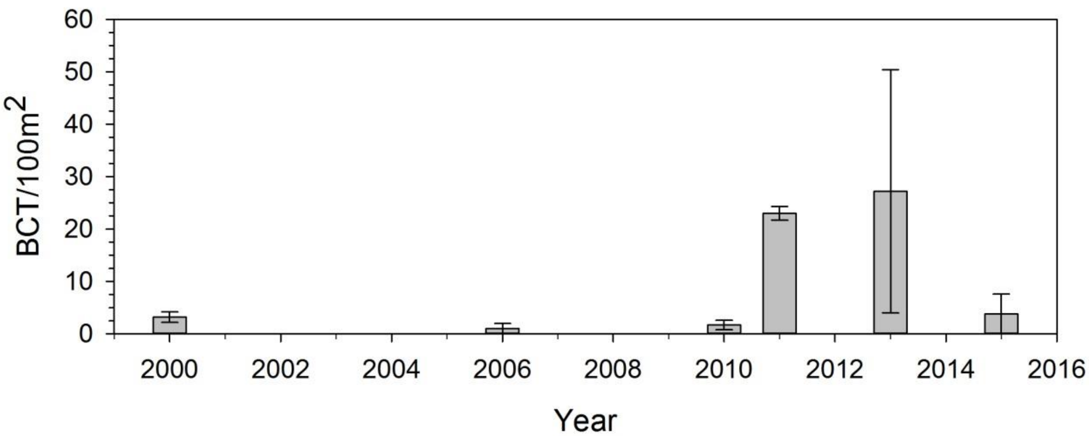

Figure 22. Average BCT density (fish/100 m^2) from 2000 to 2015 in Third Creek which is in the Malad Management Unit.

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